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C Comment Letters and Open House / Public Meeting Comments
D Glossary of Acronyms
E Aviation Committee Staff Reports
F Airline Passenger Market Analysis (October 2004)
G Calculation Records
H 2010 Planning Day Flight Schedule (Passenger Airline, Air Cargo, and General Aviation Flights)
I ATAC/HNTB Airfield Simulation Technical Memorandum
J Runway 11-29 Capacity and Delay with Master Plan 2010 Operations Forecasts (May 2005)
K Environmental Considerations in the Master Plan (July 2005)
Executive Summary

The executive summary provides a brief summary of the master plan for Oakland International Airport (OAK). It has the following sections:

1. Background and Overview
2. Summary of Aviation Activity Forecasts
3. Potential Airline Passenger Development
4. Potential Air Cargo Development
5. Potential General Aviation Development
6. Potential Airfield Development
7. Airline-Related Support Facilities
8. Airport Ground Access
9. Environmental Considerations
10. Financial Plan
11. Land-Use Maps and Recommended Studies

Background and Overview

Background

The Port of Oakland executed various settlement agreements with the surrounding communities in which the Port agreed to prepare a 20-year master plan for Oakland International Airport in accordance with Federal Aviation Administration (FAA) Advisory Circular (AC) No. 150/5070-6A, Airport Master Plans. The Port’s Aviation Planning and Development staff prepared the master plan, with assistance from specialized consultants for graphics, airfield simulation, aircraft noise analysis, and administration.

Stakeholder Advisory Committee Process

The central process for conducting the master plan was a series of meetings with a Stakeholder Advisory Committee. The role of the Stakeholder Advisory Committee was to (1) advise Port staff on long-range, high-level planning issues at OAK, (2) provide input on master plan technical issues, and (3) identify potential impacts early-on in the planning process. The Stakeholder Advisory Committee consisted of representatives (community members and/or staff) from the cities of Alameda, San Leandro, and Oakland, San Leandro Unified School District, Alameda County, and Airport users, including fixed base operators, passenger and cargo airlines, the Port’s Airline Liaison Office, and flight training / light general aviation aircraft operators. Each member of the Stakeholder Advisory Committee had formal representation in the formulation of the master plan and all members were given the opportunity to participate in development and consideration of objectives, alternatives, evaluations, etc. Some members of the Stakeholder Advisory Committee performed independent technical work to verify master plan analyses and draw their own conclusions, including preparation of simulations, spreadsheet analyses, and use of outside consultants for peer review. Committee meetings were scheduled every one to two months and were structured around master plan technical elements and topics. There were 11 Stakeholder Advisory Committee meetings (June 2004 through December 2005).

Overview

This master plan for OAK is a concept-level planning and feasibility study that identifies potential near-term projects (5-year timeframe) and provides long-term (20-year) Airport general land-use guidance. It has been prepared in accordance with the Federal Aviation Administration (FAA) Advisory Circular (AC) No. 150/5070-6A, Airport Master Plans. The following bullets provide a high-level overview of the results of the master plan:

- The primary products of the master plan are near-term (2010 to 2012) and long-term (2025) Airport land-use maps (see Chapter 8 and Figures B.1, B.2, and B.3).
- The primary focus of the master plan is on potential near-term projects (2010 to 2012) and accommodating forecast airline passenger activity in the near-term.
- Projects are not proposed to accommodate long-term (2025) forecasts, which are speculative and not reasonably foreseeable at this time. Further, the long-term, unconstrained airline passenger forecasts are not likely to be realized due to limitations on South Field (air carrier) runway capacity (i.e., a new runway is not proposed in this master plan).
- Air cargo growth is focused on existing air cargo tenants; a low-growth air cargo forecast is recommended as the Port intends to de-emphasize marketing new air cargo airlines and service.

Summary of Aviation Activity Forecasts

One of the first steps in preparing an airport master plan is to forecast unconstrained future aviation activity. Unconstrained forecasts are not constrained by any assumptions about the availability (or lack of availability) of existing and/or future Airport facilities, such as aircraft gates or runways. In other words, these forecasts represent the “natural” activity that would occur at OAK, absent any constraints on the availability of facilities. As noted throughout the master plan, the unconstrained forecast of airline passengers in 2025 is likely not achievable without an additional air carrier runway, which is not recommended in this master plan.
Estimating constrained airline passenger demand for 2025 (e.g., given capacity limitations of the existing South Field runway) is difficult and dependent on many future variables. Constrained airline passenger forecasts are dependent on many factors, including the types of airplanes the airlines choose to fly (i.e., fleet mix and the number of seats per airplane), assumed taxiway and other airfield improvements, amount of delay that the airlines and airline passengers are willing to tolerate, air travel market constraints, air traffic control rules and procedures, required aircraft-to-aircraft separations due to wake vortices, etc., all of which are likely to change between now and 2025. Table E.1 summarizes the unconstrained master plan forecasts.

### Potential Airline Passenger Development

Based on the forecasts of airline passenger and passenger airline operations, it was estimated that the Airport will need between 46 and 50 total aircraft gates (between 17 and 21 gates more than the current 24 gates plus those 5 under construction) to accommodate passenger demand in the 2010 to 2012 timeframe at a reasonable level of service (e.g., with less crowding in holdrooms, the ability to take facilities out of service to allow for routine cleaning and maintenance, etc.). From a level of service perspective, 46 to 50 total aircraft gates results in between 6 to 6.5 departures per gate per day, and 37,000 to 42,000 passengers per gate in the peak month (August). This compares to 8.9 daily departures per gate per day in August 2004 (from 24 gates), and 56,500 passengers per gate in August 2004. The national average is about 5.5 departures per gate per day.

Three possible areas at South Field were considered for the near-term potential future terminal development described above. The three areas include (1) the Central Basin (west of the FedEx Metroplex and north of Taxiway W), (2) the existing terminal area and Oakland Maintenance Center site, and (3) east of Terminal 2 in San Francisco Bay. Thirteen potential general terminal development concepts were considered in these three areas. For each concept, the following planning considerations were discussed:

- Runway access / taxiways
- Remote aircraft parking area
- Landside access roads, wayfinding, curbside length, parking (area and revenue)
- Walking distances
- Environmental constraints
- Constructability (existing facilities must remain operational)
- Total project cost (including replacement facilities)
- Other considerations specific to a particular concept

Based on the planning considerations and input from the Stakeholder Advisory Committee, it is recommended that the area designated for potential future terminal development at OAK be located in the existing terminal area and Oakland Maintenance Center site. This area is (1) less challenging environmentally, (2) more likely to be financially affordable, and (3) farthest from residences in both Alameda and San Leandro. Some of the Stakeholder Advisory Committee representatives are concerned about any future development at OAK. Other representatives indicated that mitigation measures need to be explored to offset potential environmental effects associated with existing and future aircraft operations. The representatives from the City of San Leandro indicated that terminal development in this area should be kept as far south as possible to discourage passenger airlines from using runways at North Field. Port staff explained that terminal development located anywhere in the existing terminal area and Oakland Maintenance Center site would not likely change the airlines use of the runways at OAK. However, all such concerns will continue to be considered as the Port performs more detailed planning and evaluation of potential future development. Also, input and recommendations provided by members of the Stakeholder Advisory Committee on potential future terminal development should not necessarily be considered implicit endorsement of future terminal expansion.

---

### Summary of Unconstrained Aviation Activity Forecasts

<table>
<thead>
<tr>
<th>Activity</th>
<th>2004 (Existing)</th>
<th>2010</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Airline Passengers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Million Annual Passengers (MAP)</td>
<td>14.1</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>430</td>
<td>542</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Air Cargo</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Million Annual Tons (MAT)</td>
<td>0.7</td>
<td>0.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>156</td>
<td>164</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>General Aviation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily Operations Helicopter</td>
<td>7</td>
<td>97</td>
<td>n/a</td>
</tr>
<tr>
<td>Jet</td>
<td>45</td>
<td>55</td>
<td>n/a</td>
</tr>
<tr>
<td>Piston</td>
<td>284</td>
<td>266</td>
<td>n/a</td>
</tr>
<tr>
<td>Turboprop</td>
<td>16</td>
<td>16</td>
<td>n/a</td>
</tr>
<tr>
<td>Total Daily Operations</td>
<td>938</td>
<td>1,140</td>
<td>n/a</td>
</tr>
</tbody>
</table>

(1) Unconstrained, could not be accommodated without additional runway facilities, which are not recommended in this master plan; (2) An operation is a take-off or landing; (3) In 2004, a new helicopter flight training school opened at OAK North Field. The school is ramping up training classes and flight operations through 2006. During this period, the number of helicopter operations is anticipated to grow from between 2,000 to 4,000 to just over 14,000 annual operations. After the ramp-up period, it is anticipated that helicopter flight training operations will stabilize at 7,000 annual operations. Most of the helicopter training flights are conducted over Airport property. n/a — not available (the number of aircraft operations in 2025 cannot be predicted with reliability and is dependent on many future variables).
Potential Air Cargo Development

Various areas on the Airport were evaluated for potential future air cargo development. The master plan recommends accommodating the lowest forecast of air cargo activity, rather than an aggressive forecast that would require a significant amount of new development. Instead, only a modest amount of additional on-Airport area would be needed to accommodate future air cargo growth, and this area would likely be needed adjacent to existing air cargo facilities. Although several areas were examined, including the Central Basin and North Field, the recommended areas to be designated for potential future development to accommodate growth in air cargo are (1) north of the existing FedEx Metroplex, south of Ron Cowan Parkway (to allow a modest expansion of the Metroplex) and (2) the now abandoned Oakland Maintenance Center site, which could be used for replacement air cargo facilities. The Stakeholder Advisory Committee generally agreed that the Port should consider only the lowest amount of air cargo growth (essentially modest growth of existing air cargo tenants).

Potential General Aviation Development

Except for flight training schools, it was determined that there is not a strong link between general aviation aircraft operations and the number of general aviation aircraft based at OAK. Various areas (mostly at North Field) were evaluated for potential future general aviation development. In 2010, it is estimated that an additional 3 to 7 acres would be required to base jets and turboprops at OAK, and an additional 9 to 15 acres would be required to base piston airplanes and helicopters at OAK. The area anticipated to be needed to base additional piston airplanes and helicopters is for hangars to park private airplanes, not aircraft associated with flight schools. Today, there is one flight school at North Field that trains students to fly helicopters. There are also two smaller flying clubs / businesses that offer flight instruction in small, piston airplanes.

While a specific development plan is not proposed, it is recommended that the area designated for potential new general aviation development (primarily hangars and aircraft aprons) occur at North Field, either in currently undeveloped sites (such as adjacent to Hangar 10 or off Harbor Bay Parkway) or through the redevelopment of existing general aviation facilities at North Field, subject to market interest and conditions. This type of development is well-suited for a third-party developer (where the Port leases the land to a developer who then constructs and manages the aircraft hangars). The Stakeholder Advisory Committee provided comments, but did not recommend any changes to potential general aviation development.

Potential Airfield Development

The airfield (taxiways and runways) was simulated using the 2010 operations forecasts. The major airfield simulation assumptions were as follows (note: these potential projects are not designed or proposed for approval, but were assumed as hypothetical projects for purposes of modeling the airfield):

- A new 21-gate unit terminal (for 50 total gates) would be constructed parallel to and east of Taxiway B (north of Taxiway T).
- The cargo building (now housing UPS and belly cargo) would be relocated to the northern part of the Oakland Maintenance Center site.
- A new taxiway parallel to and east of Taxiway B would be constructed.

The simulation showed that in 2010, there would be about 20 minutes of queue delay per aircraft, on average, accessing Runway 29 during the morning departures peak, with only occasional queue delays averaging less than a few minutes each for the remainder of the day.

Twenty minutes of delay per aircraft in the morning departures peak in 2010 is not desirable, so two airfield improvements were tested using the simulation model:

- Taxiway access improvements to Runway 29
- A new high-speed taxiway exit off Runway 29

The taxiway access improvements would provide additional queuing space and allow air traffic control to sequence departures more efficiently. The new high-speed taxiway exit would allow landing aircraft to exit the runway sooner, allowing departing aircraft to take-off sooner. With these two improvements, there would be about 10 minutes of queue delay per aircraft, on average, accessing Runway 29 during the morning departures peak. These two airfield improvements are not considered runway capacity improvements; rather, they reduce the number of peak-hour flights that would spill over (be delayed) into the following hour.

Although these airfield improvements would not be required in 2010 (with a new 21-gate unit terminal), they would allow the airfield to operate more efficiently, reducing delay during the morning departures peak and continuing to provide benefits beyond 2010.

Beyond 2010, Runway 11-29 will continue to experience increases in delay (although less if the two improvements above are implemented), as the morning departures peak continues longer into the morning and during other peak activity periods. Detailed simulation analyses
were not performed beyond 2010, however, it is anticipated that delay on Runway 11-29 will increase so as to warrant additional runway capacity at South Field between 2015 and 2025. Any potential new runway at South Field would have considerable environmental issues associated with filling wetlands and San Francisco Bay, as well as financial issues (e.g., several billion dollars). Therefore, it is recommended that the Port not pursue a new South Field runway at this time due to environmental and financial constraints. However, it is recommended that the Port work with its regional partners (e.g., the Regional Airport Planning Committee) to continue discussions about the future demand and capacity of runways at Bay Area airports and possible alternatives. Providing additional runway capacity for the Bay Area should be discussed and decided by the entire region. For example, other options for providing additional Bay Area runway capacity could include air service development at other regional or military airports.

The Stakeholder Advisory Committee discussion about new runway capacity at South Field was mixed. Most members preferred not to discuss the need for new runway capacity in the long-term; others saw some potential aircraft noise reduction with the outboard runway options (south of existing Runway 11-29). The master plan examined new taxiways to provide an additional connection between North Field and South Field (e.g., a new taxiway parallel to existing Taxiway B). Currently, Taxiway B can become congested with aircraft taxiing northbound (e.g., a FedEx aircraft that landed on Runway 29 taxiing to the Metroplex) versus other aircraft taxiing southbound (e.g., a corporate jet complying with the Port’s voluntary noise abatement procedures, which asks that corporate jets (and large turboprops) depart on Runway 29 at South Field, instead of using one of the runways at North Field where they typically park). The Alameda representatives on the Stakeholder Advisory Committee were interested in studying this additional taxiway in order to keep access to South Field as convenient as possible for corporate jets (and large turboprops) so that they continue to comply with the Port’s voluntary noise abatement procedures (today, about 98% of these aircraft comply). Based on measured taxi distances and estimated taxi times, as well as the airfield simulation described above, it was demonstrated that a taxiway parallel to Taxiway B on South Field (e.g., between Taxiways T and B2) would resolve most of the Taxiway B congestion and head-to-head taxi issues. Continuing this taxiway to North Field would not be required in the 2010 to 2012 timeframe.

In addition to taxiway and runway considerations, the master plan examined the need for remote (off-gate, on-Airport) remain overnight (RON) aircraft parking apron. In February 2005, there were approximately 26 acres of apron dedicated to RON aircraft parking, of which 21 acres was in use on any given night. After the Terminal 2 renovation / extension project is complete, there will be approximately 33 acres of apron dedicated to RON aircraft parking, of which 23 to 26 acres is anticipated to be required on any given night. In the 2010 to 2012 timeframe, it is estimated that between 23 and 46 acres (total) would be required. By 2025, it is estimated that between 33 and 68 acres (total) could be required (unconstrained). These estimates are not constrained by any assumptions about the availability (or lack of availability) of existing and/or future Airport facilities, such as terminal buildings, taxi-ways, and runways. That is, these estimates represent the “natural” amount of remote RON aircraft parking that would need to be accommodated at OAK, absent any constraints on the availability of terminal buildings, runway capacity, etc.

Airline-Related Support Facilities

Airline-related support facilities include belly cargo, provisioning and catering, fuel load rack, ground service equipment (GSE) maintenance facility, GSE storage and GSE parking areas, ground runway enclosure (GRE), airport rescue and firefighting (ARFF) station, terminators, and fuel storage. Potential areas on the Airport for these types of facilities were evaluated. Many airline-related support facilities should be located close to the terminal complex. However, the terminal area is already quite congested and will likely be more so in the future if a new terminal is proposed and approved in this area (north of Terminal 1, south of Ron Cowan Parkway, and east of Taxiway B). Some airline-related support facilities are currently located on the Airport, and new or replacement facilities may only be required if the existing facilities are displaced by another (presumably higher and better) use.

Airport Ground Access

The need for future airport ground access improvements was analyzed. Essentially, with the completion of the Airport Roadway Project, which rebuilt 98th Avenue and Airport Drive (up to Neil Armstrong Way) and the recent start of construction on the new terminal loop roadway and curbside project, the Airport’s primary roadway system is well situated to accommodate forecast airline passenger, air cargo, and general aviation ground access needs. Areas to accommodate future airline passenger and employee parking were also evaluated. Generally, airline passenger and employee parking should be located as close to the terminal complex as possible. However, the terminal area is already quite congested and will likely be more so in the future. Areas around the existing terminal complex should be considered for future airline passenger and employee parking (to the extent that they are available). The upland area of the Central Basin, south of Ron Cowan Parkway, near Harbor Bay Parkway, could be considered to meet additional demand for future airline passenger and employee parking because of this location’s good roadway access to/from the terminal complex and the availability of a large, upland area.
Environmental Considerations

Potential environmental opportunities and constraints associated with future growth at the Airport were evaluated, both in terms of footprint or site environmental considerations associated with new facilities (such as a potential new terminal building), and operational environmental considerations associated with increased aviation activity (i.e., more airline passengers, more air cargo weight, more flights, etc.). It is important to note that throughout the master planning process, Port staff considered environmental issues at a screening-level (identifying key environmental benefits and constraints). Because this master plan is a concept-level planning and feasibility study, it does not provide details on development plans, engineering feasibility, or environmental constraints that would be needed before the Port could decide whether to proceed with any particular project.

The environmental consideration that was studied in some detail in the master plan is aircraft noise. The aircraft noise analysis looked at both single aircraft overflight noise events. However, the Port anticipates a decrease in the number of operations of the noisiest aircraft, the Boeing 727, going from 16 daily operations in 2004 to an anticipated 6 daily operations in 2010, with only 2 departures at night (compared to 4 on average in 2004). This anticipated decrease is due to FedEx's slow phase-out of its older and noisier Boeing 727 aircraft. Because of the reduction in Boeing 727 operations, especially at night, the forecast CNEL contours to the northwest of the Airport (adjacent to the City of Alameda) are smaller than the existing CNEL contours.

Members of the Stakeholder Advisory Committee requested that the Port investigate community-requested environmental projects in the master plan. The Port and Stakeholder Advisory Committee studied a barrier to block noise from aircraft on the ground (taxi and take-off roll, except low-frequency noise) that affects residents in the Neptune Drive neighborhood in San Leandro. The noise barrier could be constructed on the Airport or in the back yards of the homes on the west side of Neptune Drive. Although such a noise barrier would provide some noise relief to residents along the west side of Neptune Drive (especially if it were to be constructed in their back yards), the residents indicated that they did not want a noise barrier constructed in their back yards, and it was determined that the best solution is to continue with the residential sound insulation program already underway in San Leandro, based on input from the Neptune Drive neighbors and the San Leandro members of the Stakeholder Advisory Committee.

The Alameda representatives on the Stakeholder Advisory Committee requested that the Port conduct a follow-on study to the master plan to investigate why some corporate jets (less than 2%) choose not to comply with the Port's voluntary noise abatement procedures, which requests that they taxi to and depart from South Field instead of North Field (during west plan, except those that can depart on Runway 33).

Finally, both the Alameda and San Leandro representatives on the Stakeholder Advisory Committee requested that the Port, in association with these cities, conduct an Airport ground traffic study to determine the amount of traffic to/from the Airport, including trucks, that uses local streets in these cities.

Financial Plan

A financial plan was prepared to evaluate the feasibility of funding the projects recommended for further analysis in the master plan, including a potential third terminal (east of Taxiway B, north of existing Terminal 1, and south of Ron Cowan Parkway), a new high-speed exit taxiway (off Runway 29), and Runway 29 taxiway access improvements. The analysis assumed that Passenger Facility Charges (PFCs) and Airport Improvement Program (AIP) grants would be used to fund a majority of the costs associated with implementing these projects. PFCs would be bonded for 30 years, and there would be a small incremental increase in airline rates and charges. The basic idea is to keep the costs that the airlines pay at a reasonable level to keep the Airport attractive to low-fare and other airlines. The financial plan suggests that these master plan projects are affordable, given certain assumptions in the analysis, which are subject to change in the future. Further, the financial plan does not consider Port-wide financial issues; it is focused solely on Airport capital projects and potential revenues. Closer to implementation of projects, the Port will need to conduct more thorough analyses on the financial feasibility of these and other Port projects from a Port-wide capital and funding perspective based on then updated financial information.

Land-Use Maps and Recommended Studies

Three land-use maps were prepared: (1) existing on-Airport land uses (e.g., airfield, passenger facilities, cargo, airline-related support, general aviation, aviation-related business, recreation, and undesigned uses), (2) near-term on-Airport land uses (2010 to 2012 timeframe), and (3) long-term on-Airport land uses (2025). These three graphics are the heart of the master plan. The primary new land-use designation in the 2010 to 2012 timeframe
is a passenger facilities area east of Taxiway B, north of existing Terminal 1, and south of Ron Cowan Parkway. If a new terminal project is proposed and approved in this area, the Oakland Maintenance Center (OMC) site would be redeveloped to support the new terminal land-use area to the south by accommodating replacement air cargo facilities, potential airline provisioning and GSE maintenance facilities, and remain overnight (RON) aircraft parking and/or airline passenger / employee vehicle parking. At North Field, the new land uses are for general aviation aircraft parking ramps and/or hangars.

The primary new land-use designation in the 2025 time-frame is additional passenger facilities at South Field, mostly to accommodate additional airline passenger / employee vehicle parking and RON aircraft parking, and additional general aviation land-use designation at North Field. A new runway at South Field (parallel to Runway 11-29) and additional aircraft gates are not shown on the long-term land-use map (2025) because such a runway is not recommended for further study and development due to environmental and financial considerations.

Finally, it is recommended that Port staff and the Stakeholder Advisory Committee continue to work together on the following projects and studies:

- Continue to study a potential Runway 29 aircraft noise barrier, on-Airport, which would provide some aircraft noise reduction for the homes on the west side of Neptune Drive in the City of San Leandro under certain, limited conditions, or other methods to reduce the effects of aircraft noise in the community (including the City of Alameda), and continue to work with the City of San Leandro on their residential sound insulation program, which is currently underway.
- Conduct a study to investigate why some corporate jets (less than 2%) choose not to comply with the Port’s voluntary noise abatement procedures, which requests that they taxi to and depart from South Field instead of North Field (except those that can depart on Runway 33).
- Conduct an Airport ground traffic study (work with the cities of Alameda, San Leandro, and Oakland to develop a study to determine the amount of traffic to/from the Airport, including trucks, that uses local streets in these cities).
- Continue the Stakeholder Advisory Committee after the master plan, with a new name, so that the Port’s Planning and Development staff can continue to meet, annually or semi-annually, with community stakeholders and Airport-users to provide updates on various projects and Airport activity, as well as receive input.
Chapter 1: Introduction and Background

“Oakland is setting an example to the cities of the country. You have here one of the finest airports I have seen… I hope that you will not forget that Oakland will continue to be in the future the guide of American aviation.”

— Charles A. Lindbergh, September 18, 1927

1.1 Introduction

Section 1.1 outlines the goals and objectives of the master plan for Oakland International Airport (OAK or the Airport) and describes the process by which it was prepared.

1.1.1 Goals and Objectives

This master plan for OAK is a concept-level planning and feasibility study that identifies potential near-term projects (5-year timeframe) and provides long-term (20-year) on-Airport general land-use guidance. It has been prepared in accordance with the Federal Aviation Administration (FAA) Advisory Circular (AC) No. 150/5070-6A, Airport Master Plans. This AC states that the goal of a master plan is “to provide guidelines for future airport development which will satisfy aviation demand in a financially feasible manner; while at the same time resolving the aviation, environmental and socioeconomic issues existing in the community” (Chapter 1, Section 3). The AC recognizes the need for flexibility in preparing master plans. “The information presented in this AC covers the planning requirements for all airports, regardless of size, complexity or role. However, the scope of study must be tailored to the individual airport, with the level of effort limited to its specific needs and problems. Based on an airport’s specific needs, certain master planning elements may be emphasized while others will not be considered at all.”

In addition to following the FAA AC, the master plan has been a vehicle for community participation in airport planning and the long-term future of the Airport. A central component of the master plan has been a series of meetings with a Stakeholder Advisory Committee, which consists of staff and community members from the surrounding cities (Alameda, Oakland, and San Leandro), San Leandro Unified School District, Alameda County, and Airport users, including fixed base operators, passenger and cargo airlines, the Port’s Airline Liaison Office, and flight training/light general aviation aircraft operators. Berkeley Keep Jets Over the Bay Committee was invited to appoint members to the Stakeholder Advisory Committee but did not.

Finally, the master plan meets the requirements of various settlement agreements with the surrounding communities.

It should be noted that the master plan for OAK does not (1) focus on detailed plans for individual Airport projects or facilities, (2) include every project that the Port might propose during the 20-year planning horizon, or (3) approve any specific projects (see Section 1.4).

1.1.2 Master Planning Process

Figure 1.1 illustrates the technical and community input process followed to prepare the OAK master plan. The technical process started with an inventory of existing conditions and forecasts of aviation activity. The forecasts were then used to develop requirements (e.g., number of aircraft gates required in a certain timeframe or area that should be allocated for a particular airport use). Based on the forecasts and requirements, various areas on the Airport were examined to determine if the potential use would be suitable for that area. A list of planning considerations was developed for each potential development area, highlighting operational, financial, and environmental opportunities and constraints. Environmental and financial considerations were then developed; finally, short-term (2010 to 2012) and long-term (2025) land-use plans were prepared.

As shown on Figure 1.1, the Stakeholder Advisory Committee participated throughout the preparation of the master plan technical work. Port staff (1) hosted two open houses/public meetings to present and discuss work on the master plan, (2) provided update briefings to the Aviation Committee of the Board of Port Commissioners at three different meetings (and the staff reports were posted on the Airport web site), (3) presented a summary of the master planning process and key findings to the Alameda, San Leandro, and Oakland city councils at regular or special meetings, and finally (4) presented a summary of the master planning process and key findings to the Regional Airport Planning Committee and the Alameda County Airport Land Use Commission.

1.1.3 Stakeholder Advisory Committee

As described in Sections 1.1.1 and 1.1.2, the central process for conducting the master plan has been a series of meetings with the Stakeholder Advisory Committee. The members of the Stakeholder Advisory Committee are listed in Appendix A, and the Stakeholder Advisory Committee meeting agendas and minutes are included in Appendix B. Port staff and consultants completed master plan technical analyses and then presented the analyses and results to the Stakeholder Advisory Committee. Committee members received an “insider’s look” at master plan technical analyses. Table 1.1 summarizes the Stakeholder Advisory Committee meeting topics and dates.

The Stakeholder Advisory Committee (1) advised Port staff and consultants on long-range high-level planning issues at OAK, (2) provided input on master plan technical issues and identified potential impacts, and (3) reported back to their respective appointing agency or organization to keep these groups informed on master plan issues and results. Each member of the Stakeholder Advisory Committee had formal representation in the formulation of the master plan and all members were

[1] While this master plan was being prepared, the FAA updated FAA AC No. 150/5070-6A, Airport Master Plans. The new document is FAA AC No. 150/5070-6B, Airport Master Plans. This master plan was prepared in accordance with the old AC (FAA AC No. 150/5070-6A) due to various agreements with the surrounding communities; however, it is generally consistent with the new AC (FAA AC No. 150/5070-6B).
given the opportunity to participate in development and consideration of objectives, alternatives, evaluations, etc. Some members of the Stakeholder Advisory Committee performed independent technical work to verify master plan analyses and draw their own conclusions, including preparation of simulations, spreadsheet analyses, and use of outside consultants for peer review.

Members of the Stakeholder Advisory Committee did not vote on particular projects or issues and were not asked to make any official decisions. However, Port staff agreed to document their concerns and issues in the master plan. This documentation occurs throughout the document, as appropriate, and Appendix C contains official comment letters, as well as comments received from the two open houses / public meetings on the master plan.

1.1.4 Port of Oakland Master Plan Team

The Port of Oakland is an “independent department” of the City of Oakland established under the City’s Charter. The exclusive control and management of the Port is vested in the Board of Port Commissioners. Per the Charter, Commissioners are nominated by the Mayor and appointed by the City Council. The Port of Oakland owns and operates OAK. Port staff responsible for managing and operating the Airport is part of the Port’s Aviation Division, which is one of three Port revenue divisions (the other two are Maritime and Commercial Real Estate).

This master plan was prepared by the Port of Oakland’s Aviation Planning and Development staff, with assistance from Port staff in other Aviation Division departments and the Engineering Division. Port staff was also assisted by specialty consultants for airfield simulation (ATAC Corporation and HNTB Corporation), aircraft noise analysis (Mestre Greve Associates and Brown-Buntu Associates), and graphics (Finger Design Associates).

1.2 History of Master Planning at OAK

Oakland Municipal Airport, the current OAK North Field, was dedicated in September 1927. From its opening through the 1930s, the Airport was the site for many historic aviation events. During World War II, OAK North Field served as the pacific base of the Naval Transport Service and the supply operations of the Army Air Forces. By the early 1950s, nine major airlines served OAK, also the site of a Naval Reserve Air Station. In 1953, over half a million airline passengers enplaned or deplaned at OAK, and a total of 190,000 aircraft movements were made by air carriers and other civilian and military aircraft. In July 1954, the Port published “Development Plan for the Metropolitan Oakland International Airport” (by Knappen-Tappets-Abbett-McCarthy, Airport Consultants), outlining expansion plans and showing the proposed new South Field with a 10,000-foot-long runway for new jet aircraft. Reclamation work began in 1955, and construction of Runway 11-29 and Terminal 1 began in 1960. South Field was dedicated in September 1962.

In 1977, the Port prepared a master plan and environmental impact report (EIR). The EIR and new Airport Layout Plan (ALP) were approved by the Board of Port Commissioners in July 1977. In 1978, the Board adopted “Oakland Airport Master Plan: 1976-1986.” This 10-year master plan examined a development plan for South Field air carrier facilities, and to a lesser degree, North Field general aviation facilities.

Due to rapid increases in general aviation activity in the late 1970s and early 1980s, a North Airport Master Plan was initiated by the Port to update and extend the analysis of general aviation expansion and development capabilities through 2000. Additionally, a supplemental EIR was prepared to study potential environmental impacts beyond those discussed in the 1977 master plan and EIR. The “Oakland North Airport Master Development Plan” (dated July 1984) and supplemental EIR were adopted by the Board of Port Commissioners in January 1985.

New planning efforts (by TRA Airport Consulting and P&D Aviation) were started in 1988 that culminated in the Airport Development Program (ADP) and related environmental documents, concluding in November 2001 when the Board of Port Commissioners certified a Final EIR, along with several addenda and a first supplemental EIR, and adopted a second supplemental EIR for the ADP projects. The ADP projects are best documented in the various ADP environmental review documents. Up until this master plan, the ADP has been serving as the Port’s planning guidance document. The Port committed to prepare this master plan with community participation as a result of various agreements settling litigation over the ADP environmental review documents.

Stakeholder Advisory Committee Meeting Topic and Dates

<table>
<thead>
<tr>
<th>Topic</th>
<th>Meeting Date(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductions, process, schedule, and inventory of existing conditions</td>
<td>June 10, 2004</td>
</tr>
<tr>
<td>Airline passenger forecasts and potential terminal development areas</td>
<td>August 19, 2004 and September 30, 2004</td>
</tr>
<tr>
<td>Air cargo forecasts and potential air cargo development areas</td>
<td>October 28, 2004</td>
</tr>
<tr>
<td>General aviation forecasts and potential general aviation development areas</td>
<td>December 9, 2004</td>
</tr>
<tr>
<td>Airfield issues</td>
<td>March 3, 2005 and March 31, 2005</td>
</tr>
<tr>
<td>Airline-related support facilities and ground access issues</td>
<td>April 21, 2005</td>
</tr>
<tr>
<td>Environmental and financial considerations</td>
<td>June 30, 2005</td>
</tr>
<tr>
<td>Land-use plan</td>
<td>August 11, 2005</td>
</tr>
<tr>
<td>Review master plan document</td>
<td>December 8, 2005</td>
</tr>
</tbody>
</table>
1.3 Organization of the Master Plan

The master plan is organized into the eight chapters as shown in Table 1.2.

In addition to the eight chapters, there are a number of appendices with useful information on the master plan. Appendices are referred to in relevant chapters and sections of the master plan as needed. Appendix D contains a glossary of acronyms used in this master plan, and Appendix E contains three staff reports to the Aviation Committee of the Board of Port Commissioners, updating them on the progress of the master plan. These reports provide a brief summary of progress on the master plan while it was being prepared.

1.4 Approval of the Master Plan

The Board of Port Commissioners approved this master plan as a planning and feasibility study for the future development of the Airport. It is important to note that this master plan is a concept-level planning and feasibility study, and it does not provide details on development plans, engineering feasibility, or environmental constraints that would be needed before the Port could decide whether to proceed with any particular project. For example, the Port would need to complete additional planning and engineering on a potential terminal concept before it could know whether it was going to be affordable and what the environmental effects might be, if any. As such, the Board of Port Commissioners has not proposed, approved, or funded any specific project or groups of projects when it approved this master plan. Rather, any project identified in the master plan would need to undergo more detailed planning, engineering and environmental review before it could proceed, including understanding how much it might cost, how it is going to be funded, and importantly, its environmental effects (in accordance with the California Environmental Quality Act and National Environmental Policy Act, as appropriate). Only then could a project or groups of related projects be approved by the Board and proceed into construction.
Figure 1.1

Technical Process

Existing Conditions
June 2004

- Forecasts of Aviation Activity
  - Airline Passengers
  - Passenger Airline Operations
  - Air Cargo Weight
  - Air Cargo Airline Operations
  - General Aviation Operations
  - Based General Aviation Aircraft
  July — December 2004

Potential Passenger Terminal Development Areas, Concepts and Planning Considerations
September 2004

Potential Air Cargo Development Areas and Planning Considerations
October 2004

Potential General Aviation Development Areas and Planning Considerations
December 2004

Airfield Issues and Potential Solutions
- Taxiways
- Runways
- Remain overnight aircraft parking
March 2005

Ground Access and Airline Support
- Airport roadways and transit access
- Catering and provisioning
- Ground service equipment maintenance
- Belly cargo
- Aircraft and ramp vehicle fueling
- Other
April 2005

Financial and Environmental Issues and Constraints
June 2005

Draft Land-Use Maps
August 2005

Master Plan Document
February 2006

Community Input

Stakeholder Advisory Committee Meetings
June 2004 — December 2005

- Update at Aviation Committee Meeting
  - January 2005
- Public Meeting/Open House
  - March 2005

Update at Aviation Committee Meeting
June 2005

Update at Aviation Committee Meeting
September 2005

Aviation Committee Review and Recommendation of Master Plan Document
February 2006

Board of Port Commissioners Approval of Master Plan Document
March 2006

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan presented many potential ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not present any particular course of action or implementation of particular ideas and concepts that may be developed and must be interpreted in the context of the entire master plan document.
2.1 Background

OAK is located in the City of Oakland, about 6.5 statute miles southeast of downtown Oakland in Alameda County along San Francisco Bay. The Airport is 2,600 acres, including 327 acres of wetlands under jurisdiction of the U.S. Army Corps of Engineers. The surrounding cities include Alameda (to the northwest), Oakland (to the north), and San Leandro (to the southeast). Access to OAK is primarily by Interstate Highway 880, Hegenberger Road, and 98th Avenue to Airport Drive (to access South Field). Other major roadways serving OAK include Doolittle Drive / State Route 61, Harbor Bay Parkway, Ron Cowan Parkway, and Davis Street / State Route 61.

OAK is a primary commercial service airport with four runways: one primary air carrier runway at South Field (Runway 11-29) and three runways at North Field (Runway 9R-27L, Runway 9L-27R, and Runway 15-33). The Airport is served by several passenger and cargo airlines. In calendar year 2004, OAK accommodated approximately 14 million annual passengers (explaning plus deplaning) and was the 33rd busiest in the U.S. in terms of total passengers, according to Airports Council International-North America. The Airport is served by FedEx, the largest air cargo operator at OAK, handling over 80% of the air cargo in and out of the Airport (by weight, in calendar year 2004), as well as United Parcel Service (at almost 15% by weight in calendar year 2004), ABX Air / DHL, Ameriflight, as well as some smaller air cargo feeders.

2.2 Existing Land-Use Map

Figure 2.1 shows an existing land-use map of OAK. The colors on the map represent the types of aviation land use, which are summarized in Table 2.1.

The largest aviation land use at OAK is Airfield, which is approximately 1,078 acres. South Field, which is defined as the Airport area south of Ron Cowan Parkway, is dominated by Passenger Facilities (approximately 208 acres), including Terminals 1 and 2, and air cargo facilities (approximately 104 acres), the largest of which is the FedEx Metroplex (their west coast hub operation). North Field (the Airport area north of Ron Cowan Parkway) contains a variety of aviation land uses, the largest of which is general aviation (approximately 85 acres), including aircraft hangars, ramps, and two fixed base operators, Kaiser Air and Business Jet Center. North Field also accommodates some air cargo facilities (approximately 30 acres), including ABX Air / DHL, and Ameriflight.

2.3 Existing Airport Data

Figure 2.2 presents existing conditions data for OAK. It summarizes general Airport characteristics, Airport employment data, operational statistics, North Field and South Field land-use data, runway data, and instrument approach capabilities.

Of particular interest is the intensity of usage of the passenger terminal facilities at South Field (see right-most column in Figure 2.2). In June 2004, each of the existing 24 aircraft gates at OAK had, on average, 8.6 departures
per day, with over 10 departures per day on average for the 12 aircraft gates used by Southwest Airlines. This compares to just over 6 departures per gate per day (from 31 gates) at Mineta San José International Airport and just over 4 departures per gate per day (from 98 gates) at San Francisco International Airport. The national average is about 5.5 departures per gate per day. Although it is generally considered good management practice to maximize use of resources such as aircraft gates, the terminal facilities (Terminals 1 and 2) at OAK are generally over stressed and provide a poor level of service for airline passengers. Examples of poor level of service in Terminals 1 and 2 include crowded corridors, hold rooms, restrooms, and concessions.

A better measure to compare gate use at different airports is passengers per gate because airports can be served by different size aircraft (in terms of the number of seats per aircraft). Some types of aircraft can take longer to unload, load, and service, increasing the time the aircraft must be parked at the gate and decreasing the number of possible departures per gate per day. For example, San Francisco International Airport is a major international gateway served by many widebody aircraft, such as Boeing 747s. Although these widebody aircraft use the gate longer, they seat more airline passengers than the smaller narrowbody fleet (e.g., in the case of a Boeing 747, almost three times as many as a typical new Boeing 737, a typical narrowbody aircraft at OAK). In April 2004, OAK accommodated 49,618 passengers per gate on average (from 24 aircraft gates), and 58,727 passengers per gate from the 12 gates used by Southwest Airlines. This compares to slightly over 30,000 passengers per gate at Mineta San José International Airport and slightly over 28,000 passengers per gate at San Francisco International Airport for all of April 2004.

This concept of departures and passengers per gate and level of service will be important in Chapter 4, where the number of aircraft gates required to serve future airline passenger demand is discussed in detail.
Oakland International Airport Master Plan
Existing Land-Use Map

Figure 2.1

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and is for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.

March 2006

LEGEND
- Airfield
- Passenger Facilities
- Cargo
- Aircraft-Related Support
- General Aviation
- Aviation-Related Business
- Recreation
- Undesignated
- Buildings
- Runways
- Taxiways
- Roadways
- Future Roadways
- Land
- Water
- Wetlands
- Bay Trail

Map not to scale

SAN FRANCISCO BAY

SOUTH FIELD

Central Basin
Ron Cowan Park
Air Cargo Way
Metropolitan Golf Links
NORTH FIELD

Harbor Bay Parkway
Airport Drive
Doolittle Drive
Old Earhart Rd.
Pardee Drive
Langley St.
Hegenberger Rd.
98th Ave.
Swan Way
Oakland VOR
North Air Traffic Control Tower
South Air Traffic Control Tower

1533
1129
27L
27R
9L
9R

Map not to scale
Airport Setting

The original Oakland Airport was built in 1927 at North Field and is still in operation today serving smaller aircraft for air cargo, general aviation and corporate jet activities. Commercial passenger and cargo jet aircraft operate from South Field, which opened in 1962.

General Characteristics

- Location: 6.5 statute miles south of the downtown area of Oakland in Alameda County along San Francisco Bay
- Elevation: 9 feet above mean sea level at the Airport Reference Point (Federal Aviation Administration)
- Size: Approximately 2,600 acres (including 527 acres of wetlands under jurisdiction of the U.S. Army Corps of Engineers)
- Employment: Over 10,000 aviation-related employees on-site, 25% are cargo-related (Bay Area Economic Forum, 1999 data)

Aviation-Related Employees On-Site

- Location of Residence
- Percent of On-Site Employees
- Alameda County 52%
- City of Alameda 7%
- City of Oakland 16%
- City of San Leandro 6%
- Source: Bay Area Economic Forum, 1999 data

- Owned and operated by the Port of Oakland
- Location Identifier: OAK
- Over $31 million in annual revenue (FY 2003-2004)

Annual Revenue, FY 2003-2004

<table>
<thead>
<tr>
<th>Revenue Source</th>
<th>Percent of Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Transportation and Parking</td>
<td>37%</td>
</tr>
<tr>
<td>Passenger-Safety Related Uses</td>
<td>40%</td>
</tr>
<tr>
<td>Air Cargo Uses</td>
<td>5%</td>
</tr>
<tr>
<td>General Aviation Uses (North Field)</td>
<td>10%</td>
</tr>
<tr>
<td>Other Uses</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Airport Role

- Primary commercial service airport

Surrounding Areas

- Cities of Alameda, Oakland and San Leandro
- Aviation-related uses surrounding the Airport include off-Airport parking lots, rental car facilities, hotel/motels, and cargo facilities

Access

- Highway Access: I-880
- Roadway Access: Hegenberger Rd, Airport Dr., Davis St., Ron Cowan Parkway, Doolittle Dr. (SR 61), Harbor Bay Parkway and 98th Ave.
- AirBART bus between the Bay Area Rapid Transit (BART) Oakland Coliseum station and Terminals 1 and 2

Operations/Statistics

- Rankings by Airports Council International for 2004
  - 1.41 million passengers in 2004 (33rd busiest U.S. airport)
  - Over 741,600 tons of air cargo shipped in 2004, and freight and freight (12th busiest U.S. airport)
  - Over 210 scheduled aircraft departing daily (30th busiest U.S. airport in terms of operations)
  - 277 based aircraft (Port inventory in Dec. 2004)
  - AirBART transported over 1.1 million passengers and employees in 2004

Figure 2.2

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Passengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>14.1 million</td>
</tr>
<tr>
<td>2002</td>
<td>14.6 million</td>
</tr>
<tr>
<td>2003</td>
<td>15.1 million</td>
</tr>
<tr>
<td>2004</td>
<td>15.6 million</td>
</tr>
</tbody>
</table>

South Field

South Field has one runway (11/29), which provides service to larger commercial aircraft, including turbo jet and turbo-fan aircraft, four-engine reciprocating powered aircraft and turbo-prop over 17,000 pounds.

Passenger-Related Facilities

- Passenger terminals 429,000 gross square feet, plus 127,000 gross square feet with the Terminal Expansion Program
- Terminal 1 (6 gates) and Terminal 2 (8 gates)
- Parking: 2,800 public and 1,500 employee parking spaces totaling 73 acres
- Overnight airport parking (33 acres)

Status of Terminal Expansion Program*

- Under construction or completion

Figure 2.3

<table>
<thead>
<tr>
<th>Project</th>
<th>Source</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal 2 Expansion and Expansion</td>
<td>Under construction</td>
<td>early 2007 (approx.)</td>
</tr>
<tr>
<td>Terminal Roadways, Curbsides, and Parking</td>
<td>Under construction</td>
<td>early 2008 (approx.)</td>
</tr>
</tbody>
</table>

Enplanements

- 2,000 aircraft per day (1987)
- 3,000 aircraft per day (2005)
- 2,000 aircraft per day (2003)
- 2,100 aircraft per day (2005)

Daily Gate Usage

- 8.6 departures per gate per day (all 24 gates)
- 10.3 departures per day from 12 Southwest Airlines gates
- 447 passengers per gate (from 9 gate)
- 49,618 passengers per gate

Bay Area Cargo Market Share

- Source: Port of Oakland
- All data is provided by the Port of Oakland unless otherwise noted.

Footnotes

1. Square footage does not include Terminal 2 expansion.
2. Upon completion of the Terminal Expansion Program, the 9th gate will be in operation.
3. Under construction of the Terminal Expansion Program, the 9th gate will be completed later in the year.
4. Source: FAA Terminal Area Forecast (actual data), January 2005

Source: Solomon Smith Barney 2003 Hub Fact Book
### 3.1 Introduction to Master Plan Forecasting

#### 3.1.1 Background

The cornerstone of a master plan is the master plan forecasts of aviation activity. Forecasts of unconstrained aviation activity, including the number of airline passengers, airline operations (an operation is a take-off or landing), air cargo weight, cargo airline operations, and general aviation aircraft, are used to inform the need for future airport facilities, such as airline passenger terminals and aprons, air cargo buildings and aprons, general aviation hangars, taxiways, runways, etc. For example, an estimate of the future number of airline passengers and passenger airline operations can be used to assess the need and timing for future terminal facilities, including the required number of future aircraft gates and the required amount of land area for a new or expanded terminal building. An estimate of the future number of aircraft operations (airline passenger, air cargo, and general aviation) can be used to assess the taxiway and runway system and identify the need and timing for new taxiways and runways.

#### 3.1.2 Planning Horizon, Planning Activity Level (PAL), and Planning Day

The basic concept of forecasting is to analyze past trends and project them forward to the planning horizon (i.e., the timeframe that is being studied). The Port and surrounding communities agreed to conduct a 20-year master plan; therefore, the long-term planning horizon for this master plan is 2025 (or 2005, plus 20 years). The near-term planning horizon is the 2010 to 2012 timeframe. Because the near-term future is inherently more certain than the long-term future, the forecasts for the near-term planning horizon are more detailed than those for the long-term planning horizon. This approach is consistent with FAA AC No. 150/5070-6A.

More important than specific timeframes is the concept of planning activity level (PAL). Future airport development should be tied to activity warranting that particular level of development, not specific years. Exact years are less important than tracking the actual passenger traffic, air cargo weight, aircraft operations, etc. For example, if airline passenger traffic does not grow as quickly as anticipated, then the demand for additional aircraft gates would occur later. Conversely, if the actual passenger traffic grows more quickly than forecast, then the demand for additional gates will happen sooner.

For a given planning horizon or PAL, it is useful to look at forecast activity on a specific planning day, usually the average annual day (AAD, or the total annual activity divided by 365 days per year) or the average day of the peak month (ADPM, or the activity in the peak month divided by 30 or 31 days per month). The planning day forecast is useful because it allows for a more detailed look at future facility requirements (compared to looking at facility requirements based on annual activity levels), and in the case of ADPM, can account for peak characteristics that would be lost if annual or AAD activity levels were used alone. For example, in the case of airline passengers, future terminal buildings (i.e., the number of aircraft gates) should be sized to reasonably accommodate the forecast passenger activity for the ADPM, and not an annual forecast or even the AAD, because the resulting facility would generally be too small and might not provide an adequate level of service during busy periods experienced during the peak month.

#### 3.1.3 Accuracy of Forecasting

Forecasts of aviation activity are important for near-term and long-term planning; however, forecasts are almost always wrong; especially for the long-term future. In other words, the actual number of passengers realized in a particular year rarely ever matches the forecast number of passengers for that year exactly. Differences between what was predicted to occur and what actually occurred usually happen because of trend-breakers. Example trend-breakers include airline deregulation, the Gulf War, September 11, 2001, jet fuel availability and prices, SARS, economic downturns, low-fare carrier competition, new types of airplanes, etc. Because of this reality, airport planners must focus on providing plans, programs, and projects that are flexible and workable for a range of possible future conditions.

#### 3.1.4 Master Plan Forecasting Process

The forecasts for this master plan were prepared in accordance with the recommendations in FAA AC No. 150/5070-6A (Chapter 5, Aviation Forecasts). Figure 3.1 summarizes the forecasting process (and forecasts) for each of the three aviation activity categories: (1) Airline Passengers / Passenger Airline Operations (top row of Figure 3.1 and Section 3.2 below), (2) Air Cargo Weight / Cargo Airline Operations (middle row of Figure 3.1 and Section 3.3 below), and (3) General Aviation / Military Operations and Based General Aviation Aircraft (bottom row of Figure 3.1 and Section 3.4 below). In each row, starting assumptions are summarized, calculations and brief explanations are presented, and forecast activity is shown. Also, each row contains a “What is this data used for?” box, which provides summary bullets of how the forecast activity is used in following master plan analyses.

The following three sections provide more detail on how the master plan activity forecasts were derived. Section 3.5 summarizes the forecasts.

3.2 Airline Passengers and Passenger Airline Operations

The basic steps for forecasting the number of airline passengers and passenger airline operations are as follows:

1. Estimate the number of annual airline passengers in 2010 and 2025.
2. Determine how many annual passengers fly on the planning day, in this case, the average day of the peak month (ADPM).
3. For 2010, estimate the future aircraft fleet (i.e., types of airplanes by airline serving OAK).
4. For 2010, put the ADPM passengers on the fleet of airplanes, up to a maximum load factor (recognizing that all airplanes departing / arriving at the Airport will not be 100% full) and determine the number of airplanes by type required to accommodate the ADPM passengers.
5. For 2010, adjust for through passengers (passengers that arrive at OAK, do not get off the airplane, and depart to the next destination), and
6. For 2010, put the required number of airplanes on a flight schedule (by airline, assuming an airline market share scenario).

Because the distant future (20 years out) is so uncertain (as described above), only basic unconstrained airline passenger forecasts are estimated for 2025 (to the ADPM level); however, the number of passenger airline operations and a detailed flight schedule are not prepared for 2025.

3.2.1 Million Annual Passengers (MAP)

Figure 3.2 shows historic and forecast number of million annual passengers (MAP) for OAK. The blue line shows historic data from 1976 through 2004. In 2004, OAK served just over 14 MAP. From 1976 to 2004, the number of passengers using OAK has grown approximately 6.9% annually, on average. The dark purple line shows the future number of airline passengers if this trend continued through 2025.

The yellow line on Figure 3.2 shows the forecast number of annual passengers prepared for the ADP environmental review documents (the solid yellow line is the actual forecast; the dashed yellow line is the trend continued past the last forecast year to 2025).

The red line on Figure 3.2 shows the FAA’s 2005 Terminal Area Forecast or TAF (the solid red line is the actual forecast; the dashed red line is the trend continued past the last forecast year to 2025). The FAA TAF is a nationwide “top down” forecast of annual airline passengers. The FAA forecasts the national growth in airline passengers, and then allocates the passengers to various terminal areas and airports, including OAK. The FAA uses the TAF primarily to estimate manpower requirements and workload for various air traffic control facilities, such as the OAK air traffic control tower.

The orange line on Figure 3.2 shows the 2000 Regional Airport System Plan (RASP) forecasts. The 2000 RASP forecasts were prepared by the Regional Airport Planning Committee (RAPC), comprised of members of the Metropolitan Transportation Commission (MTC), Association of Bay Area Governments (ABAG), San Francisco Bay Conservation and Development Commission (BCDC), and representatives of the three Bay Area air carrier airports (OAK, San Francisco, and Mineta San José international airports). Again, the solid orange line is the actual forecast; the dashed orange line is the trend continued past the last forecast year to 2025. The RASP is a “bottom up” forecast for each Bay Area airport. That is, to prepare the RASP forecasts, RAPC estimated the natural catchment area for each Bay Area airport, the types of airline passenger service expected at each Bay Area airport (e.g., primarily domestic vs. international service, primarily short-haul vs. long-haul service, etc.), and existing and new air service markets (destination cities) from each Bay Area airport. Although the RASP forecasts were prepared before the events of September 11, 2001, they are still reasonably reflective of future trends at OAK because airline passenger traffic at OAK recovered quickly after September 11, 2001 (in fact, by April 2002), and continued prior growth trends.

Based primarily on the FAA TAF and RASP forecasts, the master plan forecasts approximately 18 MAP in 2010 and 30 MAP in 2025 (unconstrained). (The 6.9% annual growth trend — the purple line on Figure 3.2 — and the ADP environmental document trend — the yellow line on Figure 3.2 — represent an extremely aggressive growth in the number of airline passengers compared to the recent trends, are unlikely to materialize, and are not used as a basis for the master plan forecasts, except for reference.) The master plan forecasts represent a 4.2% average annual growth rate from 2004 through 2010, and a 3.5% average annual growth rate from 2010 through 2025. These forecasts are not constrained by any assumptions about the availability (or lack of availability) of existing and/or future Airport facilities, such as terminal buildings, taxways, and runways. That is, these forecasts represent the “natural” amount of airline passengers that would need to be accommodated at OAK, absent any constraints on the availability of terminal buildings, runway capacity, etc. The master plan forecasts (18 MAP in 2010 and 30 MAP in 2025) are generally consistent with the 2005 FAA TAF (a “top down” forecast) and the 2000 RASP forecasts (a “bottom up” forecast). Note that these forecasts are rounded to the nearest whole MAP. As described in Section 3.1.3, the actual number of airline passengers in 2010 will not be exactly 18 MAP (and will not be exactly 30 MAP).
in 2025). In all likelihood, the actual number of airline passengers in 2010 will be slightly less or more than 18 MAP. However, 18 MAP is a reasonable PAL, and the FAA TAF and RASP forecasts suggest that 18 MAP will occur in about 2010. As described in more detail in Chapter 5, it is unlikely that the Airport will accommodate 30 MAP due to limitations on existing airfield (i.e., runway) capacity at South Field. Estimating constrained airline passenger demand for 2025 (e.g., given capacity limitations of the existing South Field runway) is difficult and dependent on many future variables. Constrained airline passenger forecasts are dependent on many factors, including the types of airplanes the airlines choose to fly (i.e., fleet mix and the number of seats per airplane), assumed taxway and other airfield improvements, amount of delay that the airlines and airline passengers are willing to tolerate, air travel market constraints, air traffic control rules and procedures, required aircraft-to-aircraft separations due to wake vortices, etc., all of which are likely to change between now and 2025.

For the purposes of planning for future terminal facility needs, the master plan also assumes 20 MAP in about 2012. This assumption is consistent with the 2005 FAA TAF and 2000 RASP forecasts (see Figure 3.2). Realistically, the Port could not plan, design, and construct future terminal facilities by 2010, so a slightly more distant year and PAL is required. To summarize, the master plan forecasts about 18 to 20 MAP in 2010 to 2012.

A high-level airline passenger market analysis is presented in Appendix F.

### 3.2.2 Average Day Peak Month (ADPM) Passengers

The next step in the airline passenger forecasting process is to estimate the number of passengers expected on the average day of the peak month (ADPM), assuming the annual passengers described in Section 3.2.1. The planning day (in this case ADPM) forecasts are useful for evaluating existing facilities and estimating future requirements, which typically cannot be done with any precision using annual passenger forecasts.

The first step in estimating ADPM passengers is to determine the peak month and how many of the annual airline passengers typically fly in the peak month. Figure 3.3 shows the number of airline passengers by month for each year from 1995 through 2004. The graph shows that in each year, August is the peak month (i.e., more passengers fly through OAK in August than any other month). The pattern of monthly passenger variation has remained relatively constant over the 10 years shown on Figure 3.3, with each month of each year generally having more passengers than the previous year. A notable exception is September 2001, which had fewer passengers than September 1995 due to the events of September 11, 2001 (the Airport was closed for several days, and many people canceled their regular travel plans after the events of September 11, 2001). Therefore, August is considered the peak month for analyzing airline passengers and passenger airline operations in the master plan.

Figure 3.4 plots the percentage of annual airline passengers for each year from 1994 through 2004 for each month of the year. Historically, approximately 9.7% of the annual airline passengers fly in August. This trend is slightly off in 2001 and 2002 due to the events of September 11, 2001. Because relatively few airline passengers flew in September 2001, the other months of 2001, including August, had slightly more passengers in terms of percent of annual passengers. Further, airline passenger traffic did not recover until April 2002 at OAK; therefore, the other months of 2002, including August, had slightly more passengers in terms of percent of annual passengers. The 9.7% trend continued in 2003 and 2004. Therefore, for the master plan, August will be the peak month, with 9.7% of the annual number of airline passengers.

Multiplying the number of forecast annual passengers in 2010 (18 MAP), 2012 (20 MAP), and 2025 (30 MAP) by 9.7% yields peak month (August) passengers for these years (unconstrained). Dividing the peak month (August) passengers by 31 days in August yields the number of ADPM passengers (unconstrained). Table 3.1 summarizes existing and forecast number of airline passengers (unconstrained):

<table>
<thead>
<tr>
<th>Existing and Forecast Airline Passengers (Unconstrained)</th>
<th>Table 3.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peak Month (August) Passengers</strong></td>
<td></td>
</tr>
<tr>
<td><strong>ADPM Passengers</strong></td>
<td></td>
</tr>
<tr>
<td><strong>MAP / Year (Approximate)</strong></td>
<td>Peak Month (August) Passengers</td>
</tr>
<tr>
<td>14 MAP / 2004</td>
<td>1,356,100</td>
</tr>
<tr>
<td>18 MAP / 2010</td>
<td>1,737,457</td>
</tr>
<tr>
<td>20 MAP / 2012</td>
<td>1,957,903</td>
</tr>
<tr>
<td>30 MAP / 2025</td>
<td>2,895,761</td>
</tr>
</tbody>
</table>

**ADPM** — Average Day Peak Month; **MAP** — Million Annual Passengers

### 3.2.3 Load Factor and ADPM Through Passengers

Now that the number of airline passengers on the planning day has been determined, the next step is to load these passengers on airplanes up to a maximum load factor. Load factor is the number of passengers on an airplane divided by the total number of seats on the airplane (e.g., a 100% load factor means that all of the seats on the airplane are occupied for that flight).

From this point forward in the forecasting process, only 18 MAP (in about 2010) is analyzed. Forecasting much beyond 18 MAP is too speculative for detailed analyses.
of aircraft operations and flight schedules. Figure 3.5 shows average monthly load factors for all airlines serving OAK for 2001 through 2004. Over all months of the year, the average load factor for all airlines serving OAK is approximately 73% (which was the load factor used in the ADP environmental review documents). However, the average load factor for August, which is the peak month, is slightly higher at about 80%. The master plan assumes that the average load factor for all airlines is 80% for the ADPM.

The next step in the forecasting process is to adjust for through airline passengers. Through airline passengers are passengers that fly into OAK, stay on the airplane, and depart after the airline boards new passengers. These passengers do not get off the airplane. The through airline passenger does not want to fly to OAK, but must do so to get to another destination. In essence, an airline with through passengers must fly more seats in and out of OAK than would otherwise be required to accommodate these passengers to other destinations. Although this is a minor consideration at OAK (i.e., it could easily be overlooked without affecting the overall forecast results), it is analyzed here for thoroughness. Figure 3.6 illustrates the number of one-way through passengers by month for each year from 1996 through 2004. Generally, the graph shows that one-way through passengers as a percent of total passengers has also been declining. For the master plan, it is assumed that one-way through passengers are 2% of the total passengers. Therefore, on the ADPM in 2010, there are approximately 2,242 two-way (in plus out) through passengers at OAK (or 2 x 2% of 56,047 airline passengers).

3.2.4 ADPM Aircraft Fleet, Flights (Operations), and Flight Schedule

The next step in the forecasting process is to determine the number and type of airplanes required to serve the forecast number of airline passengers. The number of airplanes translates to operations (take-offs and landings), and is used to estimate the number of required aircraft gates and evaluate the airfield (e.g., taxiway and runway congestion).

A detailed 17.2 MAP flight schedule from the ADP environmental review documents was used as a starting point. A detailed flight schedule contains the scheduled arrival / departure time, aircraft type, airline name, and number of seats per aircraft for each arrival / departure (flight) at OAK on the planning day (ADPM). This flight schedule was developed for the ADP environmental review documents based on considerable research about new flights and markets expected at OAK. The only change that was made to the base 17.2 MAP flight schedule was the substitution of Boeing 737-700 aircraft for Boeing 737-800 aircraft assumed in the 17.2 MAP flight schedule for Southwest Airlines. When the 17.2 MAP flight schedule was developed, the Port and its consultants thought that Southwest Airlines was going to purchase Boeing 737-800 aircraft (which has more seats than the Boeing 737-700 aircraft). These purchases have not occurred; thus, for the purposes of this master plan, it is assumed that Southwest Airlines is going to continue to purchase and fly Boeing 737-700 aircraft.

Also, the names of the airlines in the 17.2 MAP schedule have been generalized (Airline A, Airline B, etc.), except Southwest Airlines. The airline names have been generalized because the forecasts are not airline specific. That is, the forecasts assume an approximate aircraft fleet with 10 airlines, including Southwest Airlines as the dominate airline serving OAK.

Using this slightly modified flight schedule as a starting point, the next step is to load the 18 MAP ADPM passengers onto the airplanes in the flight schedule and compute the load factor. The resulting load factor is 92.5%, which is greater than the 80% target load factor, as would be expected by loading the 18 MAP ADPM passengers onto a flight schedule intended to accommodate only 17.2 MAP. The next step is to calculate the required number of seats for 18 MAP ADPM at an 80% load factor and compare it to the available seats in the modified 17.2 MAP schedule. This analysis suggests that 9,439 seats must be added to the 17.2 MAP flight schedule to accommodate 18 MAP at the 80% load factor target. The required number of new seats is then distributed to the airlines according to their existing market share at OAK. Seats must be added to each airline's fleet in whole airplane units and in accordance with airplane fleet preferences of each airline.

The next step is to summarize the new 18 MAP flight schedule. Table 3.2 shows the daily flights by aircraft type for each airline for the 18 MAP flight schedule. As shown, the master plan forecasts approximately 542 flights (take-offs and landings, or operations) on the ADPM (18 MAP in about 2010). This compares to 430 flights in August 2004 (or a 3.9% average annual increase). The Boeing 737-series aircraft continues to be the workhorse of the airline passenger fleet at OAK with about 81% of the operations (flights).

The calculations summarized above are contained in detail in Appendix G. Also, the full (detailed) 18 MAP ADPM airline passenger flight schedule is contained in Appendix H. The flight schedule shows the actual arrival and departure time by airline and aircraft type. Appendix H also contains the flight schedule for the cargo airlines and general aviation aircraft.

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3.3 Air Cargo Weight and Cargo Airline Operations

The air cargo forecasting process differs from the airline passenger forecasting process because there is less data available for air cargo (much of the data is proprietary) and because the number of flights cannot predict the amount of air cargo weight carried (or visa versa). Almost all of the air cargo weight at OAK is carried on FedEx and UPS aircraft, while smaller air cargo carriers, such as Ameriflight, contribute a significant number of cargo flights but carry a small proportion of the weight.

Forecasting air cargo activity (by weight) and air cargo operations was based on the following methodology:

1. Establish 2003 air cargo activity by weight, number of operations, and fleet mix,
2. Determine potential air cargo market options for near-term and long-term growth at OAK,
3. Estimate growth potential for air cargo at OAK relative to the Bay Area air cargo market considering historical growth rates and maturity of the OAK air cargo market to identify the appropriate growth option for the master plan,
4. Develop current and 2010 Average Annual Day (AAD) air cargo schedules, based on air cargo flight schedules prepared for previously developed environmental studies, and
5. Interpolate between the current and 2010 AAD air cargo schedule to correspond to 2010 air cargo activity levels and fleet mix established for the master plan.

Air cargo activity by weight for 2025 is also estimated; however, due to the uncertainty of long-term forecasts, an air cargo flight schedule was only prepared for 2010.

3.3.1 Million Annual Tons (MAT)

Figure 3.8 shows air cargo activity in million annual tons (MAT) for Bay Area airports. Air cargo activity for OAK in 2003 was approximately 700,000 tons (or 0.7 MAT); it was approximately 800,000 tons (0.8 MAT) in 2000. The figure includes historical air cargo activity (by weight) for San Francisco and Mineta San Jose international airports, as well as a cumulative total for air cargo activity at the three major Bay Area airports.

Future air cargo growth projections are shown on the figure using dashed lines. The RASP growth rate of 4.98% for the Bay Area is shown using a thin blue dashed line. The historical growth rate since 1996 of 5.14% is depicted using a thin line, the medium annual growth rate of 4.52% using a medium thickness line, and the low annual growth rate of 3.59% using a thick line. All three air cargo growth forecasts are significantly lower than those presented in the ADP environmental review documents or by RAPC. The OAK growth projections are presented in greater detail on subsequent figures.

The OAK air cargo growth projection from the ADP environmental review documents, shown with an orange dashed line on Figure 3.8, begins in 1997 and increases 7.84% annually to approximately 2.2 MAT in 2010. The RASP growth projection established in 1998 for OAK, shown with a yellow dashed line, increases at 4.52% annually to approximately 2.1 MAT in 2020. The ADP environmental review documents and RASP growth rates were based on the rapid growth experienced in air cargo at OAK from 1990 through 1998, neither of which accounted for maturing of the domestic air cargo market in the Bay Area that resulted in a slight reduction in activity from 1998 through 2004. Due to the reduction in air cargo activity at OAK since 1998, the ADP environmental review documents and RASP growth projections no longer correlate to air cargo conditions at OAK.

The OAK air cargo forecast attempts to remain somewhere in the middle of inevitable fluctuations in activity. One reason cargo has dropped and stabilized at the present level (aside from the Silicon Valley dot...
com bust) is that the demand for overnight deliveries has matured and reached a plateau. Also, approximately half of the Bay Area air cargo by weight moves through OAK, which limits the opportunity to further increase market share by capturing market share from other Bay Area airports. Moreover, the Port does not intend to pursue an aggressive air cargo marketing strategy (including construction of speculative air cargo facilities) to encourage new, aggressive growth in air cargo activity at OAK. Therefore, future OAK air cargo activity is projected to follow the low growth forecast.

Figure 3.9 shows the low growth forecast of 3.59% annual growth in air cargo weight at OAK which reflects the historical average annual growth in air cargo weight for the Bay Area from 1990 through the present. Forecast activity for the two major carriers, FedEx and UPS, are depicted using orange and blue lines respectively. As shown on the figure, activity is closely tied to projections of future FedEx activity, which comprises approximately 80% of the OAK air cargo market (by weight). Using the low growth forecast, OAK air cargo (by weight) projects to 0.9 MAT in 2010 and 1.5 MAT in 2025.

Two other growth projections considered for OAK, identified as medium and high forecasts, are presented on separate figures. Both figures show the forecast activity (by weight) for major air cargo carriers at OAK, as well as the total for the Airport. Figure 3.10 shows the medium growth forecast that reflects the RAPC growth rate (4.52% annual growth in air cargo weight), starting from the current activity level. Using the medium growth forecast, OAK air cargo activity (by weight) projects to 0.95 MAT in 2010 and 1.8 MAT in 2025. Figure 3.11 shows the high growth forecast, 5.14% annual growth in air cargo weight, which was developed to show the growth rate that would be necessary to reach by 2025 the weight level that was projected in the ADP environmental review documents for 2010 (2.1 MAT). At 2010 using the high growth forecast, OAK air cargo activity (by weight) projects to 1.0 MAT. The medium and high forecasts might be achievable if the Port were to pursue an aggressive air cargo marketing strategy and construct a significant amount of new air cargo facilities, which is not recommended as described above.

### 3.3.2 Annual Air Cargo Operations

Annual air cargo operations from 1999 through June 2003 at OAK for the main carrier runway at South Field are shown on Figure 3.12. Consistent with air cargo activity by weight, FedEx (shown with an orange line on the figure) comprises approximately 80% of the operations. The decline in total operations at South Field is a result of a number of air cargo carriers that have stopped operations at OAK, primarily U.S. mail flights (U.S. mail is now carried on FedEx aircraft). The air cargo data presented on Figure 3.12 comes from the Port’s landing reports.

Annual air cargo operations from 1999 through June 2003 at OAK for North Field, recorded by the Port’s Airport Noise and Operations Monitoring System, are shown on Figure 3.13. North Field tends to handle most of the air cargo feeder aircraft, with the number of operations closely tied to Ameriflight, which comprises approximately 85% of the activity. In 2000, the annual number of flights (operations) was approximately 20,000; in 2003, the annual number of flights had dropped to approximately 16,000 (a 20% decrease).

### 3.3.3 Average Annual Day (AAD) Cargo Activity

Air cargo flight schedules developed for the master plan and from the ADP environmental review documents depict average annual day (AAD) activity. Use of average day peak month (ADPM) activity, as used for flight schedules for airline passengers, would misrepresent typical air cargo activity. Unlike airline passenger activity, air cargo volume is fairly constant from month-to-month throughout the year, with the exception of December (due to end-of-year holiday shipping activity). Most December activity is handled by expansion onto the ramp and by using larger aircraft. Therefore, it is generally unnecessary to plan cargo facilities to accommodate a single month of heavy activity. Due to the heavy activity during December and relatively constant air cargo activity throughout the year, the AAD air cargo flight schedule represents activity that is slightly busier than the average for non-December months.

### 3.3.4 Air Cargo Flight Schedule

The air cargo flight schedule is used with the airline passenger flight schedule and estimated general aviation operations to evaluate the airfield (e.g., taxiway and runway congestion).

The 2000.0 MAT air cargo flight schedule and fleet mix developed for the ADP environmental review documents were used as a starting point to determine the number of aircraft arrivals and departures by individual air cargo airlines. This flight schedule was then revised to address a decrease in air cargo flight activity observed between 2000 and 2003 at North and South Fields. The total number of flights (operations) decreased from 164 to 156, corresponding to a small air cargo weight decrease from 0.8 to 0.7 MAT. The fleet mix in the 2000.0 MAT schedule was also adjusted to correspond to aircraft observed in 2003, as FedEx began to incorporate more Airbus aircraft into their OAK fleet.

The ADP environmental review documents also discussed a 2010.1 MAT flight schedule with 180 total flights, with the majority of the increase comprised of small turboprop and small twin-engine aircraft on North Field.
Table 3.3 and Table 3.4 present a summary of the master plan 0.9 MAT flight schedule for OAK, which is an interpolation for flights between the 2003 flight schedule (for 0.7 MAT), and the 2010 1.4 MAT flight schedule from the ADP environmental review documents. By 2010, air cargo airlines are assumed to have completed their conversion to the fleet mix assumed for the 2010 ADP environmental review documents flight schedule. The air cargo master plan flight schedule for 2010 has 102 flights on South Field and 62 on North Field, the same number of total flights (164) as the 2000 ADP environmental review documents flight schedule. Most of the changes in aircraft type by 2010 will occur in the FedEx fleet, with a majority of Boeing 727 and DC-10+ replaced by Airbus 300 and Airbus 310 aircraft. The OAK master plan flight schedule for 2010 includes two nighttime Boeing 727 aircraft departures (i.e., of the six total operations shown in Table 3.3, two are nighttime departures). The calculations summarized above are contained in detail in Appendix G, and the detailed air cargo flight schedule is contained in Appendix H.

3.4 General Aviation / Military Operations and Based General Aviation Aircraft

This section provides an overview of general aviation, forecasts the number of general aviation operations and aircraft based at OAK, and discusses military operations at OAK.

3.4.1 Overview of General Aviation

General aviation operations (take-offs and landings) are all operations that are not by passenger airlines, cargo airlines, or the military. General aviation aircraft range from corporate jets to small single-engine, two-seat training aircraft. According to the General Aviation Manufacturers Association (GAMA), general aviation aircraft are used for access to remote locations, aerial applications (i.e., crop dusting), business travel, emergency medical evacuation, firefighting, flight training, law enforcement, border patrols, news reporting, pipeline and power line inspection, personal / recreational travel, search and rescue operations, sightseeing or air tours, traffic reports, and weather reporting / storm tracking.
According to GAMA, over 160 million annual passen-
gers are carried on general aviation aircraft includinghelicopters, single-engine airplanes, mid-size turbo-
props, and large intercontinental corporate jets. General
aviation is relied on exclusively by more than 5,000
communities for their air transportation needs
(compared to scheduled airlines, which serve about
500 communities). Nearly 70% of the hours flown by
general aviation are for business purposes.

The next two sections of this chapter present forecasts
for general aviation operations and based general
aviation aircraft at OAK. Military aircraft operations
are then discussed.

3.4.2 General Aviation Operations

Figure 3.1 (bottom row) summarizes the general avia-
tion forecasting process. Figure 3.14 shows historic and
forecast number of general aviation operations from
1976 through 2025. The purple line shows the FAA's TAF
data for general aviation operations in the 2000 RASP. The
solid blue line shows actual general aviation opera-
tions counts maintained by the Port through its
Airport Noise and Operations Management System
(ANOMS). The Port data (blue line) is less than (below)
the FAA TAF data (purple line) because in some cases,
the FAA counts small cargo aircraft operations as
general aviation operations. Further, in some cases
the FAA data is estimated (not actually counted) by
the air traffic control tower personnel. The Port’s
ANOMS data is more accurate because it is derived from
air traffic control radar data and excludes all
passenger and cargo airline operations. Based on the
Port’s ANOMS data, there were less than 150,000
general aviation operations in 2004, or less than 410
operations each day, on average. The dashed blue line
on Figure 3.14 shows the forecast number of general
aviation operations for the master plan (the basis for
this forecast is discussed in the following paragraphs).

Figure 3.15 shows the same solid and dashed blue lines
shown on Figure 3.14 (ANOMS actual and forecast
general aviation operations data). The other lines on
Figure 3.15 show the number of operations by four
types of general aviation aircraft: piston, helicopter, jet,
and turboprop (i.e., the sum, or total, of the operations
by type of aircraft is shown with the solid and dashed
blue lines). Piston aircraft are powered by one or two
piston engines (similar to car engines) that spin a
propeller; these aircraft typically seat between two and
six passengers, including the pilots. For the purposes
of the master plan, piston aircraft include blimps, which
are typically powered by two piston engines, and motor
gliders, which are typically powered by one small piston
ingine. There are two types of piston aircraft operations:
a normal operation (which is a take-off or landing) and a
touch and go operation, which is a landing followed by
an immediate take-off (for a total of two operations).

The dashed purple line shows the anticipated number
of piston aircraft operations. As shown on Figure 3.15,
it is anticipated that the number of piston aircraft operations will continue to
decline at 1% each year (dashed purple line). These
operations are split almost evenly between
normal operations (dashed red line) and touch and
go operations (dashed light purple line).

The dashed green line shows the anticipated number
of helicopter operations. Prior to 2001, the Port had a
significant number of helicopter operations (over
30,000 annual operations) due to a flight training
school located at OAK's North Field, which is now
closed. Between 2001 and 2004, OAK had relatively
few helicopter operations (between 2,000 and 4,000
annually, or between 5 and 11 operations each day,
on average). In 2004, a new helicopter flight training
school opened at OAK’s North Field. They are ramping
up their training classes and flight operations through
2006. During this period, the number of helicopter
operations is anticipated to grow from between 2,000
to 4,000 to just over 34,000 annual operations. After
this ramp-up period, it is anticipated that helicopter opera-
tions would grow 1% annually.

The dashed orange line shows the anticipated number
of general aviation jet operations at OAK. Based on
manufacturer and other industry indicators, the
number of general aviation jet operations is anticipated
to increase at a rate of 3% each year through 2025. The
dashed yellow line shows the anticipated number
of turboprop operations at OAK. Based on historic
trends at OAK and manufacturer / industry indicators, the number of turboprop operations is not anticipated to change over the planning horizon. Table 3.5 summarizes the number of general aviation operations anticipated in 2010 (from Figure 3.15).

The next step is to convert annual general aviation operations into daily operations, which is used along with the passenger and cargo airline flight schedules to evaluate the airfield (e.g., taxiway and runway congestion). For general aviation, the planning day is the average annual day (or AAD) in 2010 (versus ADPM, because there is less overall monthly variation in general aviation operations compared to airline passengers using the terminal facilities).

The number of operations by type of general aviation aircraft on the AAD is computed by dividing the annual number of operations (by type, from Table 3.5) by 365 days per year. On the AAD in 2010, there would be approximately 434 general aviation aircraft operations, as shown in Table 3.6. The calculations summarized above are contained in detail in Appendix G, and the full (detailed) general aviation AAD flight schedule is contained in Appendix H. The flight schedule shows the actual arrival and departure time by aircraft type.

It is important to note that general aviation operations occur predominantly at North Field. For noise abatement purposes, general aviation jets and large turboprops are requested to comply with the Port’s noise abatement policies (described in detail in Chapter 6), which allows them to land at North Field but requests that they take-off from South Field during the “normal, good-weather” landing direction to the west, called west plan. During the “poor weather” landing direction, called southeast plan, which occurs less than 10% of the time, general aviation jets and large turboprops are requested to land at South Field, but are allowed to take-off from North Field. The Port’s noise abatement policies are voluntary and have over a 98% compliance rate. The forecasts presented above are not anticipated to change in any way the Port’s existing noise abatement policies or procedures.

Finally, it is important to consider the relation between general aviation operations and based general aviation aircraft (those aircraft that are based at OAK and park in a hangar or tie-down on a ramp or at one of two fixed base operators (FBOs) at North Field. For general aviation operations that are not associated with flight training schools, there is not a strong link between the number of based aircraft and operations (take-offs and landings) at OAK, especially for corporate jets and turboprops. In fact, in some cases, having additional aircraft based at OAK might actually reduce the number of general aviation operations. For example, if a corporate jet is based at OAK, it would perform two operations (one take-off and one landing) to pick-up and then deliver passengers back to OAK. However, if the aircraft were based at another airport near OAK (e.g., Hayward or Livermore), the aircraft would need to perform four operations (two take-offs and two landings) to accomplish the same flight, assuming the passengers desire to fly out of OAK because of its proximity to downtown Oakland and San Francisco, as well as other business centers. However, aircraft based at flight training schools do create a substantial amount of operations. It is also important to note that pilots of based aircraft, including those at flight training schools, are more likely than pilots of transient aircraft to comply with noise abatement policies (both because the pilots are more familiar with local flight procedures and they are part of the local community and more likely to be good neighbors). The following section describes the existing and forecast number of based general aviation aircraft at OAK.

### Existing and Forecast Annual General Aviation Operations by Aircraft Type

<table>
<thead>
<tr>
<th>General Aviation Aircraft Type</th>
<th>2004 Operations</th>
<th>2010 Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helicopter</td>
<td>2,704</td>
<td>35,507</td>
</tr>
<tr>
<td>Jet</td>
<td>16,574</td>
<td>19,937</td>
</tr>
<tr>
<td>Piston</td>
<td>103,542</td>
<td>97,238</td>
</tr>
<tr>
<td>Turboprop</td>
<td>5,822</td>
<td>5,822</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>128,642</strong></td>
<td><strong>158,504</strong></td>
</tr>
</tbody>
</table>

### Existing and Forecast Daily General Aviation Operations by Aircraft Type

<table>
<thead>
<tr>
<th>General Aviation Aircraft Type</th>
<th>2004 Average Daily Operations</th>
<th>2010 Average Daily Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helicopter</td>
<td>7</td>
<td>97</td>
</tr>
<tr>
<td>Jet</td>
<td>45</td>
<td>55</td>
</tr>
<tr>
<td>Piston</td>
<td>284</td>
<td>266</td>
</tr>
<tr>
<td>Turboprop</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>352</strong></td>
<td><strong>434</strong></td>
</tr>
</tbody>
</table>

(2) FBOs are businesses located at North Field that provide services, such as fuel sales, aircraft parking, aircraft repair, etc., to based and transient aircraft. In some cases, FBOs also offer charter services. FBOs lease land and buildings (e.g., hangars) from the Port. Currently, the two FBOs at North Field are Kaiser Air and Business Jet Center.)
3.4.3 Based General Aviation Aircraft

Table 3.7 summarizes the existing number of general aviation aircraft based at OAK, and presents the forecast number of based general aviation aircraft in 2010 and 2025.

There are about 175 general aviation aircraft parked in hangars at North Field and about 102 general aviation aircraft tied-down on one of the ramps at North Field, for a total of 277 based general aviation aircraft, as shown in Table 3.7. The next step is to estimate the number of operations that would want to be based at OAK, absent any constraints on the availability of facilities. For example, the number of based corporate jets was increased proportionally to the corporate jet fleet forecast prepared by Rolls-Royce (i.e., Rolls-Royce estimates the number of corporate jets in the entire fleet, given new orders and anticipated retirements). The number of based piston aircraft was increased based on the Port’s waiting list for hangars at North Field. In all cases, the forecasts are unconstrained; that is, these forecasts are not constrained by any assumptions about the availability (or lack of availability) of existing and/or future Airport facilities, such as hangars or ramps. In other words, these forecasts represent the “natural” number of general aviation aircraft that would want to be based at OAK, absent any constraints on the availability of facilities.

3.4.4 Military Aircraft Operations

The various branches of the U.S. military operate a wide variety of aircraft including fighter jets, large jet troop and cargo transports, corporate-type jets, and helicopters. Currently, there are no U.S. military aircraft based at OAK. However, U.S. military aircraft, as well as military aircraft from other countries, operate at OAK on a transient basis. These military aircraft typically park at one of the two FBOs at North Field and typically follow appropriate noise abatement procedures (i.e., which require jets to depart from South Field during west plan). Examples of military operations at OAK include a U.S. Air Force corporate-type jet using OAK when a high-ranking U.S. government official visits the San Francisco Bay Area, high-performance flight demonstration teams (e.g., the U.S. Navy Blue Angels) using OAK as a temporary base during Fleet Week, or a Coast Guard search-and-rescue helicopter landing at OAK for fuel.

Based on recent trends and ANOMS data, there are less than 365 annual military operations at OAK (or less than one per day, on average). For the 2010 forecast and flight schedule, one military jet operation is assumed to occur on the planning day.

3.5 Summary

This chapter described the development of unconstrained forecasts for (1) airline passengers and passenger airline operations, (2) air cargo weight and cargo airline operations, and (3) general aviation operations and based general aviation aircraft. Each of these forecasts was developed for the near-term horizon (about 2010, and in the case of airline passengers, between 2010 and 2012). Less detailed forecasts were prepared for the long-term planning horizon, which focuses only on airline passengers, air cargo weight, and based general aviation aircraft, but not the number of operations.

A composite planning day flight schedule was developed for the near-term planning horizon (2010) based on the discussion and forecasts presented in this chapter (see Appendix H). This flight schedule was used to study the number of aircraft gates required for future terminals at OAK (Chapter 4) and evaluate airfield operations (e.g., taxiway and runway congestion) and possible solutions (Chapter 5). Table 3.8 and Table 3.9 summarize the forecasts, present the total number of composite planning day operations, and summarize the number of operations by type of aircraft on the composite planning day.

### Table 3.7 – Existing and Forecast Based General Aviation Aircraft by Type

<table>
<thead>
<tr>
<th>General Aviation Aircraft Type</th>
<th>Existing (2004)</th>
<th>2010</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helicopter</td>
<td>6</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Jet</td>
<td>29</td>
<td>36</td>
<td>38</td>
</tr>
<tr>
<td>Piston</td>
<td>228</td>
<td>320</td>
<td>320</td>
</tr>
<tr>
<td>Turboprop</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>277</td>
<td>384</td>
<td>406</td>
</tr>
</tbody>
</table>

(1) Does not directly relate to aircraft operations (see discussion in Section 3.4.2)
### Summary of Unconstrained Master Plan Forecasts

<table>
<thead>
<tr>
<th>Airline Passengers</th>
<th>Existing</th>
<th>2010</th>
<th>2012</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Million Annual Passengers (MAP)</td>
<td>14.1 (5)</td>
<td>18</td>
<td>20</td>
<td>30 (10)</td>
</tr>
<tr>
<td>Planning Day Passengers (Average Day Peak Month)</td>
<td>43,745 (6)</td>
<td>56,047</td>
<td>63,158</td>
<td>93,412</td>
</tr>
<tr>
<td>Daily Operations** [A]</td>
<td>430</td>
<td>542</td>
<td>598</td>
<td>n/a</td>
</tr>
<tr>
<td>Percent of Total Daily Operations [A÷(A+B+D)]</td>
<td>45.8%</td>
<td>47.5%</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

| Air Cargo | | | |
| Million Annual Tons (MAT) | 0.74 (6) | 0.9 | n/a | 1.5 |
| Daily Operations** [B] | 156 (7) | 164 | n/a | n/a |
| Percent of Total Daily Operations [B÷(A+B+D)] | 16.6% | 14.4% | n/a | n/a |

| General Aviation | | | |
| Annual Operations** | 2,704 (8) | 35,507 | n/a | n/a |
| Planning Day Passengers (Average Day Peak Month) | 43,745 (6) | 56,047 | 63,158 | 93,412 |
| Daily Operations** [A] | 430 | 542 | 598 | n/a |
| Percent of Total Daily Operations [A÷(A+B+D)] | 45.8% | 47.5% | n/a | n/a |

### Composite Planning Day Flights by Aircraft Type, 2010

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Total</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Airline Flights (18 MAP ADPM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A319/320</td>
<td>60</td>
<td>11.1%</td>
</tr>
<tr>
<td>B737-Series</td>
<td>440</td>
<td>81.2%</td>
</tr>
<tr>
<td>B757-Series</td>
<td>8</td>
<td>1.5%</td>
</tr>
<tr>
<td>B747-Series</td>
<td>2</td>
<td>0.4%</td>
</tr>
<tr>
<td>Regional Jets</td>
<td>32</td>
<td>5.9%</td>
</tr>
<tr>
<td>Total</td>
<td>542</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

| Cargo Airline Flights (0.9 MAT AAD) | | | |
| A310-Series | 10 | 6.1% |
| A300-Series | 24 | 14.6% |
| B767-Series | 14 | 8.5% |
| B747-Series | 2 | 1.2% |
| B277-Series | 6 | 3.7% |
| DC-10 | 8 | 4.9% |
| MD-11 | 20 | 12.2% |
| Large Turboprop | 2 | 1.2% |
| Small Jet | 4 | 2.4% |
| Small Single Engine | 8 | 4.9% |
| Small Turboprop | 36 | 22.0% |
| Small Twin Engine | 30 | 18.3% |
| Total | 164 | 100.0% |

| General Aviation Operations (Flights) | | | |
| Helicopter | 97 | 22.4% |
| Jet | 53 | 12.7% |
| Piston (50% Touch & Go) | 296 | 61.3% |
| Turboprop | 16 | 3.7% |
| Total | 434 | 100.0% |

**Note:**
- An operation is take-off or landing.
- One ton is equal to 2,000 pounds (also called a short ton), which is equal to approximately 0.9 metric tons.
- In 2005, a new helicopter flight training school started operations at North Field.
- The planning day is the annual average day for general aviation.
- Calendar year 2004.
- 2003 annual average day.
- Inventory as of December 2004.
- Unconstrained could not be accommodated without additional runway facilities, which are not recommended in this master plan. n/a — not available (the number of aircraft operations cannot be predicted with reliability and is dependent on many future variables).
This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept) that was discarded, and must be interpreted in the context of the entire master plan document.

**Note:**

- **Total 317 75**
- **Total 175 102**
- **50% Touch and Go**
- **Graph 1G**
- **Jet 28 1Turboprop 5 9Helicopter 3 3**
- **Development**
- **Jet 55Turboprop 16Helicopter 97**
- **Piston 238 64Jet 44 0Turboprop 14 0Helicopter 3 11**

---

**Figure 3.1**

**Airline Passengers/Passenger Airline Operations**

- **Million Annual Passengers (MAP)**
  - 2003: 13.5 MAP
  - 2010: 18 MAP
  - 2025: 30 MAP

- **Average Day of Peak Month (ADPM) Passengers**
  - 9.7% = Annual passengers that fly in August
  - 2003: 42,562 passengers
  - 2010: 56,047 passengers
  - 2025: 93,412 passengers

- **2010 Load Factor**
  - How full are the planes on the ADPM?
  - 80%

- **2010 ADPM Through Passengers (In and Out)**
  - 2 x 2% of ADPM passengers = 2,242 passengers

- **2010 ADPM Fleet and Schedule**
  - Airline market shares, aircraft types (and seats), arrival and departure times
  - Use SER 17.2 MAP flight schedule as starting point

- **Master Plan 18 MAP ADPM Flight Schedule**
  - Fleet mix considerations
  - Change WN fleet from SER B737-800 (180 seats) to B737-700 (175 seats)
  - Constant airline market share as SER 17.2 MAP (WN approximately 62%)
  - Result: 542 flights = 80.02% load factor with 18 MAP ADPM passengers (August 2004 has 430 flights)

- **What is this data used for?**
  - Aircraft operations
  - Runway delay/capacity
  - Taxiway congestion
  - Gate requirements
  - Terminal planning
  - Other operational issues

---

**Cargo/Cargo Airline Operations**

- **Current Activity Million Annual Tons (MAT)**
  - 2003: 0.7 MAT

- **Market Options (MAT)**
  - Growth 2010 2025 Low 0.9 1.5 Medium (RASP) 0.95 1.8 High (SDFR) 1.0 1.3

- **Master Plan Market Option (MAT)**
  - Graph 2C

- **Current Average Annual Day (AAD) Activity**
  - Use 2000 AAD air cargo schedule as starting point
  - Reconcile 2000 schedule and fleet mix with current (2003) operations by carrier and runway

- **Current Average Annual AAD Flight Schedule**
  - Use 2010 SEIR (1.4 MAT) air cargo schedule
  - Interpolate flights between air cargo schedules for 0.7 MAT (2003) and 1.4 MAT

- **Adjust Current AAD Schedule to 2010 Air Cargo Activity Levels**
  - Maintain air cargo market share (FedEx approximately 85%, by weight)
  - Flights:
    - North Field – 62
    - South Field – 102

- **Master Plan 0.9 MAT AAD Flight Schedule**
  - Retain 2010 SEIR air cargo fleet mix
  - Maintain air cargo market share (FedEx approximately 85%, by weight)
  - Flights:
    - North Field – 62
    - South Field – 102

- **What is this data used for?**
  - Air cargo aircraft operations
  - Runway delay/capacity
  - Taxiway congestion
  - Other operational issues

---

**General Aviation/Military Operations**

- **Historic and Forecast Annual General Aviation (GA) Operations**
  - (Annual = 365)
  - 2010
  - Piston 97,238
  - Jet 19,937
  - Turboprop 5,822
  - Helicopter 35,907

- **Master Plan 2010 GA AAD Flight Schedule**
  - Adjust 2000 SEIR GA flight schedule by type (piston, jet, turboprop, helicopter)

- **What is this data used for?**
  - GA aircraft operations
  - Runway delay/capacity
  - Taxiway congestion
  - Other operational issues

---

**Based General Aviation Aircraft**

- **Inventory of Based GA Aircraft (Dec. 2004)**
  - Piston 139
  - Jet 28
  - Turboprop 5
  - Helicopter 2

- **2010 Based GA Aircraft Demand**
  - Piston 236
  - Jet 44
  - Turboprop 14
  - Helicopter 3

- **What is this data used for?**
  - Facility (hangar) requirements
  - Policy discussions
  - Constrained forecast development

---

**Footnotes**

1. Input data:
   - **PORT OF OAKLAND**
   - **2003 Supplemental Environmental Impact Report (SEIR) and Port data**
   - **Federal Aviation Administration (FAA)**
   - **Regional Airport System Plan (RASP)**
   - **Southwest Airlines (WN)**

2. Abbreviations/Definitions
   - **AAD** Average Annual Day
   - **ADPM** Average Day of Peak Month
   - **FAA** Federal Aviation Administration
   - **GA** General Aviation
   - **MAT** Million Annual Tons
   - **MTC** Metropolitan Transportation Commission
   - **SEIR** Supplemental Environmental Impact Report
   - **WN** Southwest Airlines

3. What is this data used for?
   - **Airline Passengers/Passenger Airline Operations**
   - **Cargo/Cargo Airline Operations**
   - **General Aviation/Military Operations**
   - **Based General Aviation Aircraft**
Figure 3.2

Million Annual Passengers (MAP), Historic and Forecast

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Monthly Passenger Variation

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.

Figure 3.3

Forecasts

LEGEND

1995
199619971998
199920002001200220032004

Monthly Passenger Variation

January
February
March
April
May
June
July
August
September
October
November
December

Thousands of Passengers

1,500
1,4001,3001,200
1,100
1,000
900
800
700600
334

March 2006

Oakland International Airport

Master Plan

March 2004

PORT OF OAKLAND

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Figure 3.4

Forecasts

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not present any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Monthly Load Factors, All Airlines

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Legend:
- 2001
- 2002
- 2003
- 2004
- Supplemental Environmental Impact Report (SEIR)/FAA National Average (73.2%)
Figure 3.6

One-Way Through Passengers

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded) and must be interpreted in the context of the entire master plan document.
One-Way Through Passengers as a Percent of Total Passengers

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only; it does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
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Figure 3.10

Million Annual Tons of Cargo (Rolling) — OAK Medium Growth Forecast (4.52%)

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and concepts. This graphic is conceptual in nature and is for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Million Annual Tons of Cargo (Rolling) — OAK High Growth Forecast (5.14%)

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded) and must be interpreted in the context of the entire master plan document.
Annual Air Cargo Operations (Rolling) — North Field

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only; it does not represent any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only; it does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.

**Figure 3.14**

**Annual General Aviation and Military Operations**

<table>
<thead>
<tr>
<th>Year</th>
<th>Arrivals/Departures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>10,000</td>
</tr>
<tr>
<td>1977</td>
<td>10,000</td>
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<tr>
<td>1978</td>
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<td>2011</td>
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<tr>
<td>2012</td>
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</tr>
<tr>
<td>2024</td>
<td>10,000</td>
</tr>
</tbody>
</table>
Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only; it does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.

Figure 3.15

Annual General Aviation Operations

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>160,000</td>
<td>140,000</td>
</tr>
<tr>
<td>2007</td>
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<tr>
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<tr>
<td>2025</td>
<td>480,000</td>
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</tr>
</tbody>
</table>

*New helicopter flight school starts operations in mid-2005. The 1% annual growth starts at the beginning of 2007.
4.1 Introduction

This chapter presents a discussion and calculations that translate the forecasts of aviation activity developed in Chapter 3 into facility and/or land area requirements to accommodate the forecast aviation activity. It then presents possible development areas and/or concepts to accommodate the requirements, including relevant planning considerations, such as operational, financial, environmental, and other issues. The chapter has five main parts: (1) airline passenger development, (2) air cargo development, (3) general aviation development, (4) airline-related support facilities development, and (5) ground access development. Potential airfield development is discussed in Chapter 5.

FAA AC No. 150/5070-6A, Chapter 6, discusses requirements, analysis, and concepts development. Although Chapter 6 of the AC does not directly address individual master plan elements (i.e., airline passenger development, air cargo development, general aviation development, etc.), it does provide planning principles and guidance. Chapter 6 of the AC discusses comparing requirements for various facilities and/or land areas (based on the forecasts of aviation activity) to the existing facilities and land areas to determine if there are any deficiencies and, if new facilities and/or land areas are required, if there is area on the airport to do so (see Chapter 6, Sections 2 (Demand-Capacity Analysis), 3 (Development Assessment), 4 (Land-Use Criteria), 5 (Terminal Planning Criteria), and 6 (Alternatives Review)). According to Chapter 6, Section 3 (Development Assessment), “In addition to determining the physical capability for expansion, as well as its timing based on development costs versus delay reduction benefits, operational reliability and safety are critical considerations.” This chapter of the master plan is based on the planning principles and guidance contained in FAA AC No. 150/5070-6A.

4.2 Airline Passenger Development

This section presents aircraft gate requirements for the near-term planning horizon (2010 to 2012) and land area requirements for potential terminal development for the long-term planning horizon to accommodate the airline passenger forecasts developed in Chapter 3. This section then presents potential terminal development areas on the Airport and potential terminal development concepts.

4.2.1 Requirements (2010 to 2012)

In Chapter 3, it was determined that the Airport would need to accommodate between 18 to 20 MAP in the 2010 to 2012 timeframe. These airline passengers (and the associated aircraft that they arrive or depart on) would use existing terminal buildings and gates (29 gates total in Terminals 1 and 2 combined, after completion of current construction projects), plus additional terminal buildings and gates, if required. This section presents discussion and calculations to determine if new gates (more than the 29) would be required to meet the near-term airline passenger forecasts (18 to 20 MAP).

The first estimate of aircraft gates requirements was calculated based on targets for average daily departures per gate and peak month (August) passengers per gate. This estimating technique considers the concept of passenger and air vehicle level of service or intensity of usage of the facilities. Although it is important to maximize use of expensive resources like terminal buildings and aircraft gates, excessive usage can lead to uncomfortable conditions for airline passengers, challenging operations for the airlines, and difficulty for the Port in maintaining the facilities. A balance is required. For example, although it might be possible to “stuff” 18 MAP through 29 aircraft gates, it would likely result in an extremely poor level of service for passengers and airplanes (e.g., dirty restrooms, overcrowded holdrooms and concessions, long security checkpoint lines, “tight” aircraft parking positions, cancelled flights to replace or maintain facilities, etc.).

For planning purposes, the master plan assumes between 6 and 6.5 average daily departures per gate per day. This assumption is considerably less than existing conditions (at 6.6 average daily departures per gate per day, see Section 2.3), but greater than other Bay Area airports (which range from about 4 to 6 average daily departures per gate per day) and the national average (of 5.5 average daily departures per gate per day).

Table 4.1 presents average daily departure per gate and total gate requirements for 18 MAP and 20 MAP. Table 4.1 shows gate use in terms of peak month passengers per gate. Again, compared to the

<table>
<thead>
<tr>
<th>Total Aircraft Gate Requirements</th>
<th>18 MAP*</th>
<th>20 MAP**</th>
</tr>
</thead>
<tbody>
<tr>
<td>August (3) Passengers (A)</td>
<td>1,737,457</td>
<td>1,957,903</td>
</tr>
<tr>
<td>Daily Operations (B)</td>
<td>542</td>
<td>598</td>
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<tr>
<td>Daily Departures (B÷2=C)</td>
<td>271</td>
<td>299</td>
</tr>
<tr>
<td><strong>Assumed Average Daily Departures per Gate (X)</strong></td>
<td>Total Gate Requirements (C÷X=Y)</td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>46</td>
<td>50</td>
</tr>
<tr>
<td>6.5</td>
<td>42</td>
<td>46</td>
</tr>
</tbody>
</table>

Ch 4 - Table 4.1

* Approximately 2010; ** Approximately 2012; (3) Peak Month; (4) In August 2004, the Airport had an average of 8.9 daily departures per gate (from 24 gates); (5) In August 2004, the Airport had an average of 56,504 passengers per gate (from 24 gates).
passenger per gate data presented in Section 2.3, the proposed peak month passengers per gate is reduced over existing conditions (offering an improved level of service and the ability to perform maintenance without ceasing operations), but still greater than other airports (making better use of facilities).

In addition to the aircraft gate planning methods described above, the airline passenger flight schedule (contained in Appendix H) was used to test the number of gates required. Based on this hypothetical flight schedule, the number of gates occupied simultaneously was counted... gates would be required to reasonably accommodate the flight schedule driven by demand for 20 MAP in about 2012.

It should be noted that the prior ADP environment documents evaluated up to 34 total aircraft gates at OAK, or 5 more than currently exist plus those under construction. Compared to 34 gates evaluated in the ADP environmental review documents, the requirements presented above represent between 12 and 16 more aircraft gates.

4.2.2 Requirements (2025)

For 2025, the anticipated number of aircraft gates is calculated and translated into a land area requirement. Terminal concepts for 2010 to 2012 can then be evaluated for the relative ease to grow beyond the 46 to 50 aircraft gates described above. Detailed aircraft gate or terminal building planning beyond the 2010 to 2012 timeframe is highly speculative. As described in detail in Chapter 5, the main air carrier runway at OAK (Runway 11-29) can accommodate the aircraft operations anticipated in the 2010 to 2012 timeframe and perhaps slightly beyond, with some modest increase in delay. However, Runway 11-29 would not be able to accommodate aircraft operations likely to be associated with 30 MAP (i.e., the long-term planning horizon in about 2025), assuming that there is no significant changes in the aircraft fleet serving OAK (see Chapter 5 for further discussion). Therefore, it is unlikely that many more aircraft gates would be required beyond the 46 to 50 gates described in Section 4.2.1 (required in the 2010 to 2012 timeframe). So, while it is prudent to look at the potential expandability of future terminals and aircraft gates, the need for additional gates might not ever come to fruition (due to the capacity of Runway 11-29), and therefore additional gates (beyond 46 to 50 total gates) are not recommended in the master plan.

The first step is to determine a range of gate requirements to accommodate 30 MAP (in about 2025). Based on calculations shown in Appendix G, it is estimated that between 65 and 75 total aircraft gates would be required to serve 30 MAP, assuming a similar aircraft fleet mix as today, or between 15 and 25 gates beyond what is required in 2010 to 2012 timeframe. The next step is to estimate how much land area is required per aircraft gate. Based on data from prior Port studies, it is estimated that 2.2 acres is required for each aircraft gate. The final step is to calculate the likely range in area required for the additional 15 to 25 aircraft gates. It is estimated that 33 to 55 acres would be required to provide an additional 15 to 25 aircraft gates over and above the area required for the 46 to 50 aircraft gates required in 2010 to 2012. The calculations summarized above are contained in detail in Appendix G.

The following section discusses potential terminal development areas and concepts based on 18 to 20 MAP terminal building and aircraft gate requirements (i.e., 46 to 50 total aircraft gates, or between 17 and 21 more gates than existing plus those under construction). The long-term area requirements to accommodate 30 MAP can be used to evaluate the various areas and concepts for relative future expandability (again, assuming additional air carrier runway capacity is available).

4.2.3 Potential Terminal Development Areas and Concepts

Figure 4.1 shows three potential areas for future terminal development at OAK. Area 1 is located in the Central Basin, south of Ron Cowan Parkway, west of the FedEx Metroplex. Any terminal development in Area 1 would require a substantial amount of wetlands fill. Area 2 is located in the existing passenger terminal area, south of Ron Cowan Parkway, east of Taxiway B, north of Taxiway T, including the Oakland Maintenance Center. Area 3 is located east of Terminal 2, largely in San Francisco Bay. Planning considerations for each area are shown on the various potential terminal development concepts located in each of the three areas. Potential terminal development Concepts 1A and 1B are located in Area 1; potential terminal development Concepts 2A through 21 are located in Area 2; and potential terminal development Concepts 3A and 3B are located in Area 3. Planning considerations examine operational, environmental, financial, engineering, and other issues associated with each potential terminal concept.

Figure 4.2 and Figure 4.3 show two potential terminal development concepts (1A and 1B) in Area 1 with appropriate planning considerations. Potential terminal development Concept 1A could be constructed to replace the entire existing terminal complex (plus those gates under construction) as well as provide the new 17 to 21 aircraft gates required in the 2010 to 2012 timeframe (for a total of 46 to 50 total aircraft gates). The existing terminal complex could then be redeveloped. Potential terminal development Concept 1B shows a new 20-gate unit terminal. Both potential terminal development concepts allow for “greenfield” site development and provide good access to the main air carrier runway, Runway 11-29. However, both concepts in Area 3 have considerable issues involving development in wetlands that would need to be overcome, including environmental, engineering, and financial challenges, as outlined in the planning considerations on each concept.
Figure 4.4 and Figure 4.5 show two potential terminal development concepts (2A and 2B) in Area 2 with appropriate planning considerations. For all of the potential terminal development concepts in Area 2 with the exception of Concept 2G, the cargo building would need to be relocated out of the center of the planning area. The cargo building houses United Parcel Service (UPS), belly cargo, the United States Post Office, as well as airline operations and provisioning space. For the purposes of considering terminal concepts in the master plan, it is assumed that the cargo building would be relocated to the Oakland Maintenance Center site south of Ron Cowan Parkway. Potential terminal development Concepts 2A and 2B add 20 gates onto the existing Terminal 1 complex. Although Concept 2A has several benefits outlined in the planning considerations, it would likely have difficult curbside operations. Concept 2B is similar to Concept 2A, but enhances landside circulation by providing a separate, consolidated baggage claim building and new baggage claim curbside roadway (splitting the enplaning and deplaning curbsides). This concept shows the existing baggage claim areas in Terminals 1 and 2 also being relocated (consolidated) in a new baggage claim building with a new curbside. Although it would likely improve landside access and circulation, it is unclear how the existing baggage claim areas in Terminals 1 and 2 would be reused and how passenger circulation would work. Further, underground or elevated baggage conveyors would need to be constructed to transport baggage from arriving flights on the airside, under or over the roadways, to the new baggage claim building.

Figure 4.6, Figure 4.7, Figure 4.8, Figure 4.9, and Figure 4.10 show potential terminal development concepts (2C through 2G) in Area 2 with appropriate planning considerations. Each concept shows a 20-gate unit terminal (not directly connected to the existing Terminals 1 and 2 complex) east of and parallel to Taxiway B. In each case, a new taxiway is also shown parallel and east of Taxiway B. This taxiway would be required to allow unimpeded, two-way aircraft taxi movements to and from the unit terminal. As described in more detail in Chapter 5, this new taxiway would also minimize delay and congestion associated with head-to-head taxi events on Taxiway B (for example, when a corporate jet at North Field taxis southbound to depart Runway 11-29 versus an aircraft taxiing northbound on Taxiway B, such as a FedEx aircraft going to the Metropole after landing). Arrows on the drawings indicate potential future expansion areas, if such expansion was ever pursued.

Potential terminal development Concept 2C (Figure 4.6) shows a terminal layout farther to the south in Area 2; Concept 2D (Figure 4.7) shows a more northerly terminal layout; Concept 2E (Figure 4.8) shows a more southerly layout with some of the more northerly aircraft pushing back onto the new taxiway parallel to Taxiway B; Concept 2F (Figure 4.9) shows a terminal complex where the terminal building (e.g., ticket counters and baggage claim) is separated from the concourse (e.g., holdrooms) to allow for a bypass roadway to the existing Terminals 1 and 2 complex; and finally, Concept 2G (Figure 4.10) shows a terminal complex on the Oakland Maintenance Center site. The planning considerations for each concept are shown on the figures.

Figure 4.11 and Figure 4.12 show potential terminal development concepts suggested by a City of Alameda and a City of San Leandro representative on the Stakeholder Advisory Committee, respectively. As stated before, input and recommendations provided by members of the Stakeholder Advisory Committee on potential future terminal development should not necessarily be considered implicit endorsement of future terminal expansion at OAK. Figure 4.11 (Concept 2H) shows only the concourse (e.g., holdrooms) in Area 2, while the terminal building (e.g., ticket counters and baggage claim) is located off-Airport. The two separate facilities would be connected by an automated people mover. That is, airline passengers would check-in at a remote (off-Airport) terminal and then take a people mover to the aircraft gates. Arriving passengers would deplane and take the people mover to the terminal building to collect checked baggage and access parking and other ground transportation. Although this concept does have the potential to locate parking and other ground transportation modes closer to Interstate Highway 880, it has a number of significant issues outlined in the planning considerations on Figure 4.11. Figure 4.12 shows a potential terminal development concept with landside facilities (e.g., parking and roadways) located farther north (closer to Ron Cowan Parkway) and the existing surface parking lot and landside portion of Terminals 1 and 2 converted to aircraft ramp and gates. Although this concept creates a consolidated terminal building, it would likely be very expensive due to the extensive renovation of existing facilities and provides relatively long walking distances to some of the aircraft gates. Other planning considerations are shown on the figure.

Figure 4.13 and Figure 4.14 show two potential terminal development concepts (3A and 3B) in Area 3 with appropriate planning considerations. Concept 3A (Figure 4.13) shows a 7-gate extension of the Terminal 2 extension project. This concept does not meet the requirements described in Section 4.2.1 (i.e., 17 to 21 aircraft gates in the 2010 to 2012 timeframe). Although this concept provides additional aircraft gates, it does not provide any additional terminal building facilities, such as ticket counters, baggage claim, security checkpoint lanes, curbside roadways, etc., which would likely be required to accommodate the increased number of aircraft gates and airline passengers. It is also unclear whether this concept could be constructed due to height limitations imposed by protected airspace for the approach to Runway 29. Concept 3B (Figure 4.14) shows a 20-gate expansion of Terminal 2 into San Francisco Bay. Both figures contain relevant planning considerations.

4.2.4 Recommended Terminal Development Area

It is recommended that the Port further study potential near-term terminal development concepts in Area 2 in accordance with the requirements outlined in Section 4.2.1 (i.e., 17 to 21 aircraft gates in the 2010 to 2012 timeframe).
timeframe). It appears that Areas 1 and 3 would be
difficult to develop from an engineering and
environmental perspective, requiring considerable fill of
wetlands and/or San Francisco Bay. Further, because of
the engineering and environmental challenges, Areas 1
and 2 would likely be considerably more expensive
(possibly unaffordable) to develop for terminal uses
than Area 2. From a land-use perspective, Area 2 is
congruent to the existing terminal area. Now that the
Oakland Maintenance Center is available, it is possible
to demolish it and use the area for terminal or facilities
displaced by terminal development in Area 2, such as
the cargo building.

Potential terminal development Concept 2C (Figure 4.6)
is assumed for the purposes of the airfield analyses
discussed in Chapter 4. This is not a preferred concept,
but one example of many possible terminal concepts
(several of which are described above and shown in the
figures). For the airfield analyses, the modeller must
know where the required aircraft gates are located in
order to simulate aircraft taxiing on the taxiway system.

It is important to note that although several potential
terminal development concepts were developed and
evaluated, the master plan is focused on overall on-
Airport land-use guidance. The concepts simply
demonstrate that there is a variety of possible
terminal configurations that are possible in each area.
Even though this master plan recommends future
terminal development be considered in Area 2, this
master does not recommend a specific terminal devel-
opment concept. The Port will be proceeding with
separate studies to develop and further evaluate the
feasibility of terminal concepts within Area 2.

As described above, potential long-term (2025)
terminal development (i.e., a significant number of
additional gates beyond 46 to 50 total aircraft gates
required in the 2010 to 2012 timeframe) is not recom-
ended in the master plan due to capacity constraints
on Runway 11-29.

4.2.5 Stakeholder Advisory Committee
Recommendations

Although some Stakeholder Advisory Committee
representatives are concerned about any Airport devel-
opment, the majority favored potential terminal
development in Area 2. According to the stakeholders,
Area 2 has fewer environmental challenges, already
contains the other terminals, and is farther away from
the surrounding communities.

The City of San Leandro representatives to the
Stakeholder Advisory Committee indicated that they
prefer potential terminal development concepts that
are farther south, closer to the existing terminal area.
They felt that terminal development farther north
could encourage airlines to start using the runways at
North Field, especially for landings, as Runway 11-29 at
South Field becomes more congested. Port staff
explained that the exact placement of terminal facili-
ties within Area 2 would not likely influence whether
airlines would choose to use the runways at North
Field. Compared to other U.S. airports, any aircraft
gates constructed in Area 2 would still be quite conve-
niently located relative to Runway 11-29 at South Field
(i.e., taxi times to/from Runway 11-29 would still be
quite reasonable). Also, airport landing at North Field
have a considerable distance to travel to get to any
gates at South Field due to circuitous taxi routes and at
least two runway crossings (three if landing on Runway
27L). Further, from a runway capacity perspective, it
would not be desirable to mix lighter general aviation
aircraft that operate at North Field with larger aircraft
flown by the passenger airlines.

As stated before, input and recommendations provided
by members of the Stakeholder Advisory Committee on
potential future terminal development should not
necessarily be considered implicit endorsement of
future terminal expansion at OAK.

4.3 Air Cargo Development

Just as there is not a strong link between air cargo
weight and cargo airline operations (see discussion in
Section 3.3), there is also not a strong link between
these metrics and the amount of land area required for
air cargo facilities at OAK. Professional judgment and
experience, however, suggest that if the Port pursued
an aggressive air cargo marketing and development
strategy, a significant amount of new facilities and land
area would be required. However, as described in
Section 3.3, it is recommended that the Port not pursue
an aggressive air cargo development program, and
instead allow existing tenants to grow at their existing
and/or relocated facilities, with modest expansions, as
necessary. This strategy results in the low air cargo
growth forecast described in Section 3.3, and forms the
basis of the potential air cargo development areas
described below.

Figure 4.15 shows four areas that were considered to
to potentially accommodate future air cargo needs at the
Airport. Planning considerations for each of the four
areas are shown on the figure. The areas include:
• Area 1, North Field (north of Runway 9L/27R) — this
area would provide approximately 180 acres for
potential new air cargo development;
• Area 2, the Central Basin (south of Ron Cowan
Parkway and north of Taxiway W) — this area would
provide approximately 330 acres for potential new air
cargo development;
• Area 3, south of Ron Cowan Parkway and north of
the existing FedEx Metroplex — this area would
provide approximately 330 acres for potential new air
cargo development;
• Area 4, the existing air cargo area at South Field and
the Oakland Maintenance Center site — this area
would allow modest expansion and/or relocation
of existing air cargo facilities (e.g., the existing UPS /
cargo building).
Figure 4.16 shows a sample air cargo development concept developed for Area 1. As shown on the figure, the Infield Road from the Airport Development Program would provide landside access from Doolittle Drive and Earhart Road to the North Field cargo area. Runway 15-33 would be closed to accommodate a large multi-tenant cargo facility. Additional facilities would potentially be provided east of Hangar 10. These facilities could potentially accommodate all air cargo activity at the Airport.

Figure 4.17 shows sample air cargo development concepts developed for Area 2 and Area 4. As shown on the figure, the air cargo development in Area 2, the Central Basin, would be provided for east of Hangar 10. This site could potentially accommodate all air cargo activity at the airport.

Development of Area 4, near the current Oakland Maintenance Center, would accommodate non-FedEx cargo carriers at OAK but is confined by existing roadways (i.e., Airport Drive and Ron Cowan Parkway) and Taxiway B. Development in this area would separate air cargo facilities from the passenger airline facilities while retaining the existing access on both landside and the airfield. Regardless of any future terminal development plans, UPS, which currently operates from the cargo building, has expressed interest in relocating their operation to Area 4 near the Oakland Maintenance Center to consolidate their operation so that it runs more efficiently with improved ground access (i.e., their trucks would be able to exit Airport Drive sooner and not mix with airline passenger traffic as long).

A development concept for Area 3 is not shown as this site could only really be used for an expansion of the FedEx Metroplex.

Based on (1) the low growth in air cargo weight and operations anticipated through 2010 (due to not pursuing an aggressive air cargo growth strategy described above) and (2) input from the Stakeholder Advisory Committee, it is recommended that the area designated for potential growth in air cargo be located at existing air cargo facility locations (such as the FedEx Metroplex), with small expansions, as needed, into Area 3 (for FedEx) and a possible relocation of air cargo facilities within Area 4 (e.g., to accommodate potential new terminal development).

4.4 General Aviation Development

This section presents land area requirements for the near-term planning horizon (2010) and long-term planning horizon (2025) to accommodate based general aviation aircraft forecasts developed in Chapter 3. This section then describes potential general aviation development areas on the Airport.

### 4.4.1 Requirements (2010 and 2025)

Section 4.3.3 describes the forecasts of based general aviation aircraft at OAK. The first step is to convert these forecasts to land area requirements based on existing general aviation area allocations and associated number of aircraft parking positions (either on a ramp or in a hangar). Based on existing hangar and ramp area used for general aviation at OAK, the approximate area required is between 0.47 and 1 acres for jets and turboprops (per aircraft), and between 0.09 and 0.15 acres for piston airplanes and helicopters (per aircraft). Multiplying these area requirements by the forecast number of based aircraft yields the total land area required to accommodate the forecast number of based general aviation aircraft. In 2010, it is estimated that an additional 3 to 7 acres would be required to base jets and turboprops at OAK, and an additional 9 to 15 acres would be required to base piston airplanes and helicopters at OAK. The area anticipated to be needed to base piston airplanes and helicopters is for hangars to park private airplanes, and not new flight schools. Today, there is one flight school at North Field that trains students to fly helicopters. There are also two smaller flying clubs / businesses that also offer flight instruction in small, piston airplanes.

In 2025, it is estimated that an additional 11 to 22 acres of land (beyond the area required for 2010, or 14 to 29 acres more than existing) would be required to base jets and turboprops at OAK. It is estimated that no additional land would be required for piston aircraft and helicopters (beyond the area required for 2010).

Table 4.2 summarizes the estimated land areas required to meet the forecasts for based general aviation aircraft. The calculations summarized above are contained in detail in Appendix G.
It is important to note that not all of this demand may be met at OAK. The forecasts of based general aviation aircraft and associated land area requirements are unconstrained and represent an estimate of what would "naturally" occur at OAK, assuming appropriate facilities, such as ramps and hangars, are available for use. The following section examines possible areas on the Airport to meet the projected general aviation land requirements described above. Any actual development would be subject to further study, engineering and environmental evaluations, and financial constraints.

4.4.2 Potential General Aviation Development Areas

Figure 4.18 shows four possible areas for general aviation development at North Field, as well as relevant planning considerations for each. In general, future general aviation development at North Field consists of ramps and hangars for aircraft parking (i.e., for based aircraft). Most future general aviation development will likely be large hangars for jets and turboprops and smaller groups of hangars (like T-Hangars or Box-Hangars) for piston aircraft and helicopters. Ramp area is also required to support aircraft maneuvering and access to hangars.

The brown areas on Figure 4.18 are areas that are currently undeveloped (except for taxiways, in some areas) and could support future general aviation development. Area 1 would be most suited for smaller piston aircraft and helicopters (as opposed to corporate jets and turboprops), whereas Areas 2 and 3 would be suited for any type of general aviation development. Because Areas 1 through 3 are undeveloped, any general aviation development in these areas would require considerable effort (e.g., grading, engineered fill, etc.) and utility upgrades and extensions (e.g., power, sewer, storm water drainage, communications, etc.). Appropriate planning considerations for possible general aviation development in Areas 1 through 3 are shown in Figure 4.18.

The blue area on Figure 4.18, Area 4, shows existing facilities (hangars and ramps) at North Field (many of which are currently used for general aviation) that could be redeveloped and/or renovated to provide state-of-the-art general aviation facilities to meet future demand. Many of the existing buildings (hangars) and/or sites in Area 4 are either not well configured compared to modern aircraft hangars, or do not meet current fire and seismic design requirements. Planning considerations associated with redeveloping the existing general aviation uses in Area 4 are presented on Figure 4.18.

Another possibility (not shown on Figure 4.18) is to locate general aviation facilities, such as fixed base operators, at South Field, in the Central Basin, north of Taxiway W and west of Taxiway B, for example. The basic premise is that aircraft accessing this new facility may be more inclined to use Runway 11-29 at South Field (as opposed to the runways at North Field), reducing the number of general aviation aircraft (e.g., corporate jets) that land and take-off at North Field, and possibly reducing the associated noise effects in the surrounding communities. However, developing general aviation facilities at South Field has some challenges that would likely be difficult to overcome and may not reduce the effects of aircraft noise. First, any general aviation development at South Field would likely require filling a significant amount of wetlands. It might be difficult to obtain permits to fill these wetlands because North Field is a viable alternative (as evidenced by its use today for general aviation operations). Not only are there potential environmental consequences associated with filling wetlands, but there are associated engineering and financial issues as well. Many of the existing on-Airport wetlands are used to support the overall storm water drainage system at the Airport. Although most corporate jets and large turboprops (98%) already take-off on Runway 29 in west plan (in accordance with voluntary noise abatement procedures), locating large general aviation facilities at South Field may cause a significant increase in the number of corporate jets and large turboprops that also land on Runway 29, increasing congestion and delay at South Field. Finally, there might be some small piston aircraft and helicopter operations that would occur with the development of such facilities at South Field. From a runway capacity perspective, these smaller, lighter aircraft do not mix well with the larger aircraft flown by the passenger and cargo airlines.

Therefore, it is recommended that Areas 1 through 3 be considered to meet the land area requirements for based general aviation aircraft at OAK, subject to market conditions and developer interest. Areas 1 through 3 could be developed either by the Port or a tenant or a third-party developer in association with the Port (which might need to extend and upgrade utilities and/or other basic infrastructure). Further, Area 4 could be considered for redevelopment as opportunities arise.

4.5 Airline-Related Support Facilities Development

Airline-related support facilities include belly cargo, provisioning and catering, fuel load rack, ground service equipment (GSE) maintenance, GSE storage and GSE parking areas, ground runup enclosure (GRE), airport rescue and firefighting (ARFF) station, titrator, and fuel storage. Some airline-related support facilities are currently located on the Airport, and new facilities would only be required if the existing facilities are displaced by another (presumably higher and better) use. Examples include belly cargo, provisioning and catering, fuel load rack, GRE, and the ARFF station.
Because a potential future terminal was identified in the area east of Taxiway B, north of existing Terminal 1, and south of Ron Cowan Parkway, some airline-related support facilities in this area, such as belly cargo and some airline provisioning facilities, may need to be relocated to other areas, if a terminal were indeed pursued in this area.

Some airline-related support facilities are not currently located at OAK, such as GSE maintenance. Based on airline requests for such a facility, a new GSE maintenance facility is required and recommended for further study. Additionally, the airlines have requested that the triturator facility be expanded and upgraded. A renovated and upgraded triturator facility is also required and recommended for further study in the master plan.

Figure 4.19 shows various areas on the Airport that might be suitable to locate the various airline-related support facilities. The matrix on the figure identifies which airline-related support facilities would be suitable in each of the 12 potential on-Airport development areas. Planning considerations for each type of use are also presented.

Many of the airline-related support facilities should be located as close to the terminal complex as possible, making Area 1 (and some of the surrounding areas) attractive. However, the terminal area is already quite congested and will likely be more so in the future (e.g., with potential future terminal development). The need for airline-related support facilities in Area 1 will need to be balanced with other uses competing to be located in Area 1.

4.6 Ground Access Development

4.6.1 Introduction

FAA AC No. 150/5070-6A, Chapter 6, Requirements Analysis and Concepts Development (Section 3, Development Assessment) provides scant information on the study of ground access. Development criteria and goals used in recent ground access development at OAK (including the recently completed Airport Roadway Project and the new roadway and curbside expansion project) have been applied to the development of any future sites. An important planning consideration in ground access development is proximity of parking sites to activity centers at the terminals and transport between the two. There are 13 different potential ground access development areas identified on Figure 4.20, for the following four categories: potential parking development (nine areas), access and roadways (two areas), ferry access (two areas), and a preferred regional rail connection corridor (i.e., BART Connector). Planning considerations for each of the ground access development area categories are shown on the figure.

4.6.2 Parking Areas

The potential Airport parking areas are shown in Areas 1 through 9 on Figure 4.20. Area 1 depicts the extent to which the current parking bowl will expand after the current runway and curbside expansion project is complete. It includes the current Hourly and Daily Lot A parking areas, and serves both Terminals 1 and 2.

Areas 2 and 3 would be accessed from Airport Drive via the new John Glenn Drive. Area 2 encompasses the current Daily Lot B, Southwest Provisioning Building, Oakland Maintenance Center (OMC) hangar and airfield ramp area, and the OMC employee parking area. Area 3 is the current Economy parking lot.

Areas 4 and 5 would be accessed from Neil Armstrong Way via the Ron Cowan Parkway underpass at Airport Drive. Area 4 includes the Neil Armstrong Way employee lot and adjacent construction lay-down areas; Area 5 is currently used as a construction lay-down area.

Area 6, north of the FedEx Metroplex that includes wetlands and other undeveloped land parcels, could be accessed from Ron Cowan Parkway or Air Cargo Way. Area 7, the 65-acre Matiland upland site, would use Ron Cowan Parkway to access both the site and the terminal facilities. Area 8, parallel to Runway 15-33 at North Field, is adjacent to and accessed from Harbor Bay Parkway. A possible terminal area connection to Area 9 (located adjacent to Doolittle Drive) may require development of an access route within Area 11.

4.6.3 Access / Roadways

Airport Drive provides public and non-public access and is the main circulation roadway at the Airport, with direct connection to Interstate Highway 880 via Hegenberger Road and 98th Avenue, and to the surrounding communities via State Highway 61 (Doolittle Drive and Davis Street). Access to on-Airport FedEx cargo facilities from Airport Drive is provided via Ron Cowan Parkway and Air Cargo Way. An important planning consideration is to separate airline passenger traffic from other vehicles on the main inbound roadway to enhance safety and simplify wayfinding. Airport Drive becomes a one-way, two-lane (soon to be three-lane, with the new roadway and curbside expansion project) loop roadway in the terminal area that provides access to public and employee parking lots and the terminal curbsides. Adjacent to the terminal curbsides, the roadway is comprised of three inner and two outer lanes, in addition to single loading lanes at the terminal and island curbsides.

The current roadway system, which is under construction in the loop area until 2008, is expected to accommodate passenger demand increases anticipated due to the expansion and renovation of Terminal 2.
4.6.4 BART Connector

The currently planned corridor for the BART Connector, the automated people-mover connection to the regional rail transit system, is shown on the figure with a blue dashed line. Following are BART Connector planning considerations:

- Constrained access corridor between outbound lanes of Airport Drive and the golf course;
- At-grade alignment preferred (where possible) to minimize the cost of the guideway;
- Airport station should serve existing and potential future terminal, and allow for potential new garage and other on-Airport facility development;

The estimated time of completion for the BART Connector is uncertain and depends on when the project starts, which depends on the availability of funding. In the meantime, the Port is examining all available options for incorporating the BART Connector into the Port’s planning. If the BART Connector project begins, it would require at least 4 years to be constructed. The development of the Airport station will be planned and designed to tie into terminal facilities built on the Airport, as well as any potential parking garage. The BART Connector is a joint project between the Port and BART, with the Port providing significant funding and staff involvement in acquiring other funding. BART is the contracting agent and will construct and operate the system.

4.6.5 Ferry Access

Areas 12 and 13 on Figure 4.20 depict two potential cargo ferry areas (Areas 12 and 13). In 1998, FedEx commissioned a team to investigate the potential for cargo ferry service between the Peninsula and OAK using hovercraft. FedEx had previously considered such an option for transit from John F. Kennedy International Airport to Wall Street in New York. FedEx, UPS, Airborne Express and DHL (now ABX Air / DHL) were interested but unable to agree on the location of the facility on the Peninsula and configuration of the inside of the hovercraft. Alaska Airlines and United Airlines were also interested in using the service to transport parts for their maintenance facilities at OAK, but those have since closed. After further study, it is evident that the potential environmental effects would also be substantial and may be cost prohibitive. Consequently, no action has been taken on the cargo ferry project and none is anticipated in the near-term (2010) planning horizon.

Areas 12 and 13 on Figure 4.20 could also be considered for passenger ferry access to and from OAK. Passenger ferries could provide service to/from Bay Area ferry terminals (e.g., the Ferry Building in downtown San Francisco or the Larkspur Ferry Terminal in Marin County) or San Francisco International Airport. Because these ferries would be accessing the airfield, there are significant safety and security issues that would need to be addressed. Passenger ferry access is not anticipated in the near-term (2010) planning horizon, but could be considered longer-term depending on roadway congestion and markets served at OAK and San Francisco International Airport.
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Planning Considerations

- Possible replacement terminal facilities (could more easily allow for parallel runway north of Runway 11/29)
- Greenfield site (less disruption to operations during construction, no design constraints/efficient terminal layout, minimized walking distances, no existing facilities to relocate)
- Expensive site preparation (i.e., large amount of fill, grading, soil preparation, environmental/wetlands mitigation)
- Environmentally constrained site (i.e., wetlands, wildlife, etc.)
- Good airfield access (gates near runway) site can accommodate remote aircraft parking
- Adequate area for new access roads and parking
- Separate terminal operations area
- Difficult wayfinding for airline passengers (i.e., there would be two distinct terminal areas)
- Difficult/expensive BART Connector alignment
- Possible increase in vehicle trips to/from Airport through Alameda
- Moves terminal closer to residential areas

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Planning Considerations

- Greenfield site (less disruption to operations during construction; no design constraints; efficient terminal layout; minimal walking distances; no existing facilities to relocate)
- Expensive site preparation (i.e., large amount of fill, grading, soil preparation, environmental/wetlands mitigation)
- Environmentally constrained site (i.e., wetlands, wildlife, etc.)
- Good airfield access (gates near runway/site can accommodate remote aircraft parking)
- Adequate area for new access roads and parking
- Separate terminal operations area
- Difficult wayfinding for airline passengers (i.e., there would be two distinct terminal areas)
- Difficult/expensive BART Connector alignment
- Possible increase in vehicle trips to/from Airport through Alameda
- Adds terminal closer to residential areas

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Planning Considerations

- Adds onto existing Terminal 1
- Relatively short walking distances (no longer than existing)
- Relatively inexpensive site preparation and terminal development
- Must relocate existing facilities (e.g., cargo and airport operations buildings)
- May need to demolish Oakland Maintenance Center hangar
- Possible impact to international arrivals aircraft parking
- Minimal/no environmental site impacts
- Good airfield access (gates near runway)
- Difficult curbside operations (insufficient curbside length and the Terminal 1 curbside is already congested)

Legend:

- Future Aircraft Gate
- Future Buildings
- Future Terminals
- Future Roads
- Future Landfill/Ramp
- Aircraft Gate
- Airport Land
- Wetlands
- Buildings
- Runways
- Taxiways
- Roadways
- Future Roadways
- Land
- Water
- Bay Trail

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Planning Considerations
- Adds onto existing Terminal 1 and consolidates baggage claim in new facility (north of existing terminals)
- Relatively inexpensive site preparation and terminal development
- Must relocate existing facilities (e.g., cargo and airport operations buildings)
- May need to demolish Oakland Maintenance Center hangar
- Possible impact to international arrivals aircraft parking
- Minimal/no environmental site impacts
- Good airfield access (gates near runway)
- Expands landside accessibility (by separating vehicles picking up arriving passengers at the baggage claim curbside and vehicles dropping off departing passengers at the ticket curbside)
- Modifies existing garage design.

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Planning Considerations

- New unit terminal northwest of Terminal 1 (near Terminal 1)
- Relatively short walking distances
- Relatively inexpensive site preparation and terminal development
- Must relocate existing facilities (e.g., cargo building)
- May need to demolish Oakland Maintenance Center hangar
- Impact to international arrivals aircraft parking
- Minimal/no environmental site impacts
- Good airfield access (gates near runway); likely requires new taxiway parallel to Taxiway B
- Difficult curbside operations (short weave distance between new unit terminal and Terminal 1)
- May require new pedestrian connection from proposed BART Connector station to new unit terminal

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Planning Considerations
- New unit terminal northwest of Terminal 1 (near Oakland Maintenance Center)
- Relatively short walking distances
- Relatively inexpensive site preparation and terminal development
- Must relocate existing facilities (e.g., Southwest Airlines’ new provisioning building, cargo building)
- Must demolish Oakland Maintenance Center hangar
- No impact to international arrivals aircraft parking
- Minimal/no environmental site impacts
- Long taxi distances to northernmost gates/likely requires new taxiway parallel to Taxiway B
- Less difficult curbside operations (longer weave distance between new unit terminal and Terminal 1)
- Consumes considerable amount of vehicle parking (in existing Daily B)
- Would require additional BART Connector station at new unit terminal

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Planning Considerations

- New unit terminal north-northwest of Terminal 1
- Preserves more landside area for access/curbides and/or vehicle parking
- Relatively short walking distances
- Relatively inexpensive site preparation and terminal development
- Must relocate existing facilities (e.g., cargo building)
- May need to demolish Oakland Maintenance Center hangar
- Impact to international arrivals aircraft parking
- Minimal/no environmental site impacts
- Likely requires new taxiway parallel to Taxiway B/aircraft at north-northwest, gains pizote onto new taxiway parallel to Taxiway B
- Difficult curbside operations (short weave distance between new unit terminal and Terminal 1)
- May require new pedestrian connection from proposed BART Connector station to new unit terminal

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Planning Considerations

- New unit terminal northwest of Terminal 1 splits terminal from concourse to allow for bypass roadway access to existing Terminals 1 and 2
- Improved roadway and curbside operations/minimum weaving
- Longer walking distances than other Area 2 terminal options
- Relatively inexpensive site preparation but more expensive terminal development than other Area 2 terminal options
- Must relocate existing facilities (e.g., cargo building)
- Must demolish Oakland Maintenance Center hangar
- Impact to international arrivals aircraft parking
- Minimal/no environmental site impacts
- Good airfield access (spine near runway) likely requires new taxiway parallel to Taxiway B
- Consumes considerable amount of surface vehicle parking area
- May require new pedestrian connection from proposed BART Connector station to new unit terminal

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Planning Considerations

- New unit terminal on Oakland Maintenance Center site
- Relatively short walking distances
- Relatively inexpensive site preparation and terminal development
- Must relocate Southwest Airlines’ new provisioning building
- Must demolish Oakland Maintenance Center hangar
- May need to demolish a portion or all of the cargo building
- No impact to international arrivals aircraft parking
- Minimal/no environmental site impacts
- Long taxi distances to/from South Field runway
- Body requires new taxiway parallel to Taxiway B
- Less difficult curbside operations (longer weave distance between new unit terminal and Terminal 1)
- Cargo truck traffic must mix with airline passenger traffic
- Would require new BART Connector station at new unit terminal

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Planning Considerations

- New remote (off-Airport) unit terminal with automated people mover link to/from concourse
- New remote unit terminal would not impact traffic operations in existing on-Airport terminal area
- Limited available off-Airport sites for new unit terminal
- Port would need to purchase additional land for new remote unit terminal
- Expensive automated people mover link
- Separate terminal operations area
- Would require mechanism to securely transfer checked baggage to/from concourse
- Must relocate existing facilities (e.g., cargo building)
- Impact to international arrivals aircraft parking
- Minimal/no environmental site impacts on Airport
- Good airfield access (gates near runway)/likely requires new taxiway parallel to Taxiway B
- Difficult wayfinding for airline passengers (i.e., there would be two distinct terminal areas)
- Airlines may not staff remote unit terminal and concourse
- Possible conflicts with BART Connector alignment and/or golf course

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Planning Considerations

- New consolidated terminal north of existing terminals (consolidates existing terminal functions – bag claim, ticketing, etc. – in new building north of existing terminals)
- May need to demolish a portion or all of the cargo building
- Must demolish the Oakland Maintenance Center hangar
- No impact to international arrivals aircraft parking
- Minimal/no environmental site impacts for terminal; roadways would likely need to traverse wetlands
- Good airfield access (gates near runway)/likely requires new taxiway parallel to Taxiway B
- Requires a two-level curbside roadway (which is relatively expensive)
- Relatively short walking distances to new gates; relatively long (excessive) walking distances to existing gates
- Relatively expensive; must replace existing facilities (bag claim, ticketing, etc.) in new consolidated terminal and remodel existing buildings into a different use (e.g., hold rooms)

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Planning Considerations

- Extension of current Terminal 2 extension project
- Expensive site preparation (i.e., large amount of fill, grading, soil preparation, environmental/wetlands mitigation)
- Does not provide new terminal facilities (e.g., ticket counters, security checkpoint, baggage claim, etc. to accommodate passengers through new gates)
- Does not provide new curbside (the Terminal 2 curbside is already congested)
- Good airfield access (gates near turnpike/site can accommodate remote aircraft parking)
- Long walking distances
- Adds terminal closer to residential areas
- May not be feasible due to airspace height restrictions

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Planning Considerations
- Expansion of current Terminal 2 renovation and extension project
- Expensive site preparation, including 30+ acres of Bay fill (likely not affordable)
- Environmentally constrained site (i.e., Bay fill, wetlands, wildlife, etc.)
- Good airfield access (gates near runway)/site can accommodate remote aircraft parking
- Difficult curbside development (the Terminal 2 curbside is already congested)
- Adds terminal closer to residential areas

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Planning Considerations

Area 1
- Provides a significant amount of area for new air cargo development (~180 acres)
- Requires closure of Runway 15/33 (for full site development)
- For larger aircraft, long taxi distances to/from South Field runways (for noise abatement procedures)
- Significant mixing of larger air cargo aircraft and lighter general aviation aircraft at North Field
- Would require new roadway connections to Doolittle Dr. (State Rte. 61) and/or Harbor Bay Parkway to provide sufficient landside access
- Requires a significant upgrade to North Field infrastructure (e.g., storm drains, sewers, power, data/communications, etc.)

Area 2
- Provides a significant amount of area for new air cargo development (~330 acres)
- Expensive site preparation (i.e., large amount of fill, grading, soil preparation, environmental wetlands mitigation)
- Environmentally constrained site (i.e., wetlands, wildlife, etc.)
- Possible conflicts with potential terminal development area (still being considered by Stakeholder Advisory Committee)
- Good airfield access (site near South Field runways for noise abatement procedures)
- Possible good site access via Ron Cowan Parkway

Area 3
- Allows for modest expansion of FedEx's existing site/facilities (~29 acres)
- Some environmental constraints (i.e., wetlands)

Area 4
- Provides for modest expansion and/or relocation of existing cargo facilities in this area (~40 to 90 acres)
- Possible conflicts with potential terminal development area (still being considered by Stakeholder Advisory Committee)
- Adequate airfield access (site near South Field runways for noise abatement procedures)
- Depending on site within this area, may require mixing of cargo truck traffic and airline passenger vehicle traffic

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Figure 4.16

Oakland International Airport Master Plan
March 2006

Sample Air Cargo Development Concept Area 1

LEGEND

- Future Aircraft Gate
- Future Buildings
- Future Taxiways
- Future Roads
- Future Landfill Ramp
- Airport Land
- Wetlands
- Buildings
- Runways
- Taxiways
- Roadways
- Future Roadways
- Land
- Water
- Bay Trail

= 1 Acre

Development south of Infield Rd. requires closure of Runway 15/33.
Planning Considerations

Area 1
- Provides 20 acres ± for new general aviation (e.g., hangar) development
- Access would likely need to be from Harbor Bay Parkway
- Good site to consolidate smaller general aviation hangars (e.g., replacement facilities for older hangars, such as the new "T" hangars and Port-A-Ports)
- Somewhat longer taxi distances to Runways 27L/R and 33 than from existing new "T" hangars and Port-A-Ports
- Extension of the site would require relocating the City of Oakland soccer fields
- Unknown site preparation requirements and utility upgrades (possibly extensive and expensive)
- Moves general aviation development closer to residential areas (compared to existing Area 4)

Area 2
- Provides 65 acres ± for new general aviation (e.g., hangar) development
- Access would likely need to be from Harbor Bay Parkway
- Potential site for new corporate jet facilities (e.g., hangars and related offices)
- Taxiway infrastructure may need to be upgraded
- Shorter taxi distances for landing aircraft (Runways 27L/R), but longer taxi distances for departing aircraft (Runway 29 for noise abatement)
- Possible conflicts with potential air cargo development area (still being considered by Stakeholder Advisory Committee)
- Unknown site preparation requirements and utility upgrades (possibly extensive and expensive)
- Moves general aviation development closer to residential areas (compared to existing Area 4)

Area 3
- Provides 15 acres ± for new general aviation (e.g., hangar) development
- Hangar development in this area would likely require a new landside roadway with a connection to Earhart Rd. and/or Doolittle Dr. (Streer 61)
- Possible site for new corporate jet facilities (i.e., hangars and related offices)
- Shorter taxi distances for landing aircraft (Runways 27L/R), but longer taxi distances for departing aircraft (Runway 29 for noise abatement)
- Possible conflicts with potential air cargo development area (still being considered by Stakeholder Advisory Committee)
- Unknown site preparation requirements and utility upgrades (possibly extensive and expensive)
- Moves general aviation development closer to residential areas (compared to existing Area 4)

Area 4 (Redevelopment)
- Upgrades and/or redevelops existing (but aging) general aviation (or other aviation) facilities at North Field
- Relatively good landside access on existing roadways at North Field
- Taxi distances the same as existing
- Less site preparation and utility upgrades likely required
- Possible asbestos and lead paint issues
- Requires mixing of various types of aircraft (piston, jet, cargo, etc.)

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Planning Considerations

Belly Cargo
- Provides a building where the public can pick up and drop-off cargo (small boxes, packages) that goes in the belly of passenger aircraft.
- Requires public landside access.
- Requires aisle access to transport cargo between the aircraft and building.
- Should be located in proximity to airport gates.

GSE Storage/Parking
- Provides a location to store and park GSE while it is not in use.
- Should be located in proximity to airport gates.

Ground Ramp Enclosure (GRE)
- Provides a sound-deadening enclosure for airlines to ramp aircraft engines after maintenance.
- Should be located in proximity to airport gates.

Fuel Storage
- Provides a location to store and/or park GSE while it is not in use.
- Requires public landside access.
- Requires aisle access to transport fuel between the aircraft and building.
- Should be located in proximity to airport gates.

Provisioning/catering
- Provides a building for storage and preparation of in-flight food, snacks, drinks, ice, etc.
- Requires landside access for deliveries and aisle access to transport food between the aircraft and building (without aisle access, trucks must use landside roadways and an airlift gate to transport food between the aircraft and building).

Fuel Load Rack
- Provides a location and facilities to refuel ground service equipment (GSE) and fill aircraft fuel trucks.
- Receives fuel via pipelines and hydrants, fuel trucks, and/or gasoline) in tanks; distribution to aircraft

Ground Service Equipment (GSE) Maintenance
- Provides a location for airlines to conduct maintenance on GSE, such as belt loaders, push-back tug, bag tugs and carts, etc.
- Requires public landside access.
- Requires aisle access to transport equipment between the aircraft and building.
- Should be located in proximity to airport gates.

Airport Rescue and Firefighting (ARFF)
- Provides a building for storage and preparation of ARFF equipment.
- Requires landside access for deliveries and aisle access to transport equipment between the aircraft and building.
- Should be located in proximity to airport gates.

Provisioning Building
- Provides a building where the public can pick up and drop-off catering, catering supplies, etc.
- Requires public landside access.
- Requires aisle access to transport food between the aircraft and building.
- Should be located in proximity to airport gates.

Southwest Atrium
- Provides a location for airlines to conduct in-flight food, snacks, drinks, ice, etc.
- Requires public landside access.
- Requires aisle access to transport food between the aircraft and building.
- Should be located in proximity to airport gates.

Triturator
- Provides a location to unload aircraft lavatory waste.
- Should be located in proximity to airport gates.

Fuel Load Rack
- Provides a location to store and park GSE while it is not in use.
- Requires public landside access.
- Requires aisle access to transport fuel between the aircraft and building.
- Should be located in proximity to airport gates.

Ground Service Equipment (GSE) Maintenance
- Provides a location for airlines to conduct maintenance on GSE, such as belt loaders, push-back tug, bag tugs and carts, etc.
- Requires public landside access.
- Requires aisle access to transport equipment between the aircraft and building.
- Should be located in proximity to airport gates.

Airline Support Facility
- Provides a building where the public can pick up and drop-off cargo (small boxes, packages) that goes in the belly of passenger aircraft.
- Requires public landside access.
- Requires aisle access to transport cargo between the aircraft and building.
- Should be located in proximity to airport gates.

GSE Storage/Parking
- Provides a location to store and park GSE while it is not in use.
- Should be located in proximity to airport gates.

Ground Ramp Enclosure (GRE)
- Provides a sound-deadening enclosure for airlines to ramp aircraft engines after maintenance.
- Should be located in proximity to airport gates.

Fuel Storage
- Provides a location to store and/or park GSE while it is not in use.
- Requires public landside access.
- Requires aisle access to transport fuel between the aircraft and building.
- Should be located in proximity to airport gates.

Provisioning/catering
- Provides a building for storage and preparation of in-flight food, snacks, drinks, ice, etc.
- Requires landside access for deliveries and aisle access to transport food between the aircraft and building (without aisle access, trucks must use landside roadways and an airlift gate to transport food between the aircraft and building).

Fuel Load Rack
- Provides a location and facilities to refuel ground service equipment (GSE) and fill aircraft fuel trucks.
- Receives fuel via pipelines and hydrants, fuel trucks, and/or gasoline) in tanks; distribution to aircraft

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- Requires public landside access.
- Requires aisle access to transport equipment between the aircraft and building.
- Should be located in proximity to airport gates.

Airport Rescue and Firefighting (ARFF)
- Provides a building for storage and preparation of ARFF equipment.
- Requires landside access for deliveries and aisle access to transport equipment between the aircraft and building.
- Should be located in proximity to airport gates.

Provisioning Building
- Provides a building where the public can pick up and drop-off catering, catering supplies, etc.
- Requires public landside access.
- Requires aisle access to transport food between the aircraft and building.
- Should be located in proximity to airport gates.

Southwest Atrium
- Provides a location for airlines to conduct in-flight food, snacks, drinks, ice, etc.
- Requires public landside access.
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- Should be located in proximity to airport gates.
This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not portray any particular course of action (it might represent an idea or concept that was discarded) and must be interpreted in the context of the entire master plan document.

Note:

San Francisco Bay

1 Acre

Legend:
- Potential Access/Roadways
- Development Areas
- Potential Cargo Ferry Access Development Areas
- BART Connector
- Wetlands
- Buildings
- Runways
- Roadways
- Future Roadways
- Land
- Water
- Bay Trail

Figure 4.20

Potential Ground Access Development Areas
Chapter 5: Potential Airfield Improvements

“The airport runway is the most important mainstreet in any town.”
— Norm Crabtree, former aviation director for the state of Ohio
5.2.2 Potential Airfield Improvements

Two potential improvements to minimize the queue delay accessing Runway 29 in the morning departure peak were examined. The first potential improvement would be a new taxiway parallel to Taxiway W between Runway 29 and Taxiway U and parallel to Taxiway U between Taxiway T and Taxiway W, as shown in green on Figure 5.2. The facilities shown in blue on Figure 5.2 (a new taxiway parallel to and east of Taxiway B, potential terminal development Concept 2C, and relocation of the cargo building) are assumed for the purposes of the simulation modeling. These new access taxiways would allow for additional aircraft queuing distance and minimize the possibility that the morning departure queue would extend to the east apron. More importantly, dual taxiways feeding Runway 29 would allow for traffic control to optimize departure sequencing to take full advantage of existing runway capacity. Generally, aircraft turning in the same direction after take-off (e.g., two aircraft heading to Southern California) require more spacing between consecutive departures than aircraft turning in different directions (e.g., one aircraft going to Southern California and a second aircraft going to the east coast). Therefore, these taxiways would allow ATC to queue aircraft with different departure turns in two distinct queues and allow them to depart alternately, minimizing delay. Today, the only opportunity to “jump” the queue to achieve improved sequencing is for an aircraft to access Runway 29 from Taxiway U (resulting in a shorter runway length). The second potential improvement would be a new high-speed exit from Runway 29, between existing high-speed exits at Taxiways V and Y, as shown as Taxiway Z on Figure 5.3. As with Figure 5.2, the facilities shown in blue on Figure 5.3 are assumed for the purposes of the simulation modeling. Based on aircraft breaking performance estimates, only about 13% of the 2010 aircraft fleet mix would be able to exit Runway 29 at Taxiway V (i.e., the aircraft, after landing, is going too fast to exit here). Meanwhile, the high-speed exit at Taxiway Y is too far down the runway (i.e., aircraft are going quite slow by the time they arrive at Taxiway Y and then because of its geometry, it takes aircraft farther away from the terminal area increasing taxi times). Port staff and airfield consultants simulated a new high-speed exit between Taxiways V and Y, about 700 feet east of Taxiway V.

Figures 5.2 and 5.3 contain relevant planning considerations associated with each potential airfield improvement. It is important to note that these two taxiway improvements are independent of one another and a potential future terminal. That is, each one individually (without the other one) would reduce airport congestion and delay, as summarized below. Moreover, these two improvements (either one or both) would also reduce airport congestion and delay, even if a new terminal is not pursued.

5.2.3 Airfield Simulation Results

The purple line on Figure 5.4 shows the average queue delay per aircraft by time of day in 2010 on the existing airfield (i.e., with no airfield improvements), assuming the master plan flight schedule developed in Chapter 3 and contained in Appendix H. Queue delay is experienced while waiting in line on Taxiways W and U to access Runway 29 (during west plan). In August 2005, the average queue delay per aircraft was estimated to be less than 10 minutes during the morning departures peak (between about 7 and 9 AM), with only occasional queue delays averaging less than a few minutes each for the remainder of the day. In 2010, the average queue delay per aircraft jumps to about 20 minutes during the morning departures peak. Although a 20-minute average delay during the peak hour in 2010 may not cause the airlines serving OAK to change their flight schedules, it is severe enough to consider improvements to minimize it.

First, the potential Runway 29 access improvements (Figure 5.2) were simulated in the airfield simulation model. If this improvement was implemented, it is estimated that the average queue delay per aircraft would be reduced by up to 23% (over the entire planning day), and the average queue delay per aircraft in the morning peak hour drops from about 20 minutes to about 12 minutes (see the blue line on Figure 5.4).

Second, the new high-speed taxiway was simulated (Taxiway Z on Figure 5.3). Approximately 79% of the 2010 aircraft fleet mix would be able to exit here, as opposed to only 13% being able to exit at Taxiway V, reducing runway occupancy time upon landing by about 15% (because aircraft do not have to taxi all the way to Taxiway Y to exit Runway 29). Taxi time and distance is reduced by approximately 9%, saving the airlines fuel and providing a potential air quality benefit. Moreover, because landing aircraft would be able to exit the runway sooner, aircraft queued for departure can depart sooner. It is estimated that the average departure queue delay per aircraft would be reduced by up to 21% over the entire planning day, and the average queue delay per aircraft in the morning peak hour drops from about 20 minutes to just over 15 minutes (see the green line on Figure 5.4).

Taken together, these two potential taxiway improvements allow Runway 11-29 to operate more efficiently during the morning departures peak period. The average queue delay per aircraft in 2010 with both improvements is plotted by time of day on Figure 5.4 in red. The average queue delay per aircraft during the morning departures peak drops to about 10 minutes (from about 20 minutes with no improvements).

These potential improvements were discussed with the Stakeholder Advisory Committee. Although there were no strong objections to either potential improvement, the Committee did ask several questions about whether...
these potential improvements increase the capacity of Runway 11-29. These types of improvements reduce delay during the peak period and allow the runway to operate more efficiently, closer to its maximum potential capacity (i.e., capacity limited by required FAA aircraft separation standards). Without these potential airfield improvements, the airlines would simply accept the delay, and some aircraft would not depart in the peak hour, but be delayed to the subsequent hour. Delay costs the airlines money and is inconvenient for airline passengers. The capacity of a single runway is fixed, given a fleet mix, arrival/departure schedule, and weather. In other words, in 2010, it is unlikely that the airlines would choose to add or cancel a flight or even change their flight schedule due to these potential improvements. Runway 11-29 can accommodate the anticipated 2010 flight schedule (with the associated assumptions, such as 21 additional aircraft gates) with some increase in delay (less with the two airfield improvements described above). Finally, it should be noted that these potential airfield improvements may improve air quality because aircraft would be idling in queue for a shorter duration on average.

Therefore, it is recommended that the Port further study both of these potential airfield improvements, including additional engineering, environmental, and economic feasibility studies.

5.3 Potential North Field Taxiway Improvement

Shown in Figure 5.5, a potential new taxiway at North Field, parallel to Runway 9R-27L, was also evaluated (but not simulated) as part of the overall airfield evaluation. This taxiway would improve safety by minimizing the number of runway crossings required for an aircraft that lands on Runway 27L (the longest runway at North Field) that needs to taxi to South Field (e.g., passenger airlines that land at North Field when Runway 11-29 is closed). For example, if an aircraft landed on Runway 27L and needed to taxi to South Field today, it would exit Runway 27L to the right at Taxiway J, cross Runway 9L-27R, taxi eastbound on Taxiway C, cross Runway 9L-27R, and then cross Runway 9R-27L, before proceeding southbound on Taxiway B to South Field, for a total of three runway crossings. With the potential new taxiway shown on Figure 5.5, aircraft landing on Runway 27L could make a left turn off the runway, taxi eastbound on the new taxiway to Taxiway B, and proceed to South Field without crossing any runways. It also provides a shorter taxi route for these aircraft. Although this taxiway does provide some benefits, it is not required and its benefits may not outweigh its costs (construction costs may be substantial due to poor soil conditions and drainage issues in this area).

Several members of the Stakeholder Advisory Committee from the City of San Leandro expressed concern that this potential new taxiway at North Field would make North Field more convenient for use by passenger and cargo airline aircraft parking at South Field. Because of the likely marginal benefit to cost comparison and because of concerns raised by the Stakeholder Advisory Committee, this potential taxiway improvement is not recommended for further study and development.

5.4 Potential North Field–South Field Taxiway Connector

A potential new North Field–South Field taxiway connection was analyzed to reduce taxi time and delays. The only existing connection is Taxiway B, which runs between Taxiways W and H at North Field, and crosses Ron Cowan Parkway on a bridge. Taxiway B currently only allows one-way taxi flow (southbound or northbound) at any one time, with two bypasses provided on Taxiway R and Taxiway V. For example, if a FedEx aircraft landed on Runway 29 and received permission to taxi to the Metroplex, then a corporate jet taxiing southbound on Taxiway B to depart on Runway 29 would have to wait (e.g., north of Taxiway R) until the FedEx aircraft pulled into the Metroplex (clear of Taxiway B) before proceeding southbound on Taxiway B. Alternately, the northbound FedEx aircraft might have to hold on Taxiway V to allow the southbound corporate jet to bypass. Once the corporate jet is past Taxiway T, the FedEx aircraft could then taxi to the Metroplex on Taxiway B. All aircraft movements, including the use of Taxiway B and bypass issues, are directed by air traffic control tower personnel.

Several members of the Stakeholder Advisory Committee expressed interest in minimizing taxi time and delays in order to encourage compliance with voluntary noise abatement procedures, which require corporate jets and large turboprops, which land and park at North Field, to depart from Runway 29 (taxing from North Field to South Field southbound on Taxiway B). Some Committee members were interested in minimizing head-to-head taxi events on Taxiway B, which require one aircraft to hold so another can safely bypass it, which could discourage the use of Runway 29 if excessive delay is incurred due to this holding / bypassing. Further, some Committee members were interested in studying if any of these taxiways shorten the taxi distance and time between North Field and South Field (Runway 29), thereby encouraging compliance with the voluntary noise abatement procedures described above.

Using the airfield simulation for 2010 described above, it was determined that most head-to-head taxi events on Taxiway B occur south of Taxiway B1 (south of Ron Figure 5.6 shows five potential new North Field–South Field taxiway connections, T0 through T4. Potential Taxiways T1 through T4 require a new bridge to be constructed over Ron Cowan Parkway (i.e., Ron Cowan Parkway would need to be depressed under any new taxiway connection between North Field and South Field). Other planning considerations are shown for each option on Figure 5.6.
Cowan Parkway) on South Field. These occur, for example, when a FedEx aircraft is traveling northbound on Taxiway B (after landing) to the FedEx Metroplex, while a FedEx aircraft is traveling southbound on Taxiway B to the FedEx Metroplex, which would require a new terminal to support a new connection in this vicinity (as simulated), solves the head-to-head taxi issues on Taxiway B, without the need for a new connection between North Field and South Field (and crossing Ron Cowan Parkway). For additional details on the airfield simulation results, see ATAC Corporation’s technical memorandum contained in Appendix I.

The second study was to determine if any of the potential North Field–South Field taxiway alternatives (T0 through T4) significantly shorten the taxi distance and time from ... ranges from just over 8 minutes (from Business Jet Center) to just under 10 minutes (from Kaiser Air). These times will vary with taxi speed and potential delays crossing runways. The final step is to compare the taxiway alternatives to existing conditions to determine if there is any taxi distance or time benefit, as shown in Table 5.1. The calculations summarized above are contained in detail in Appendix G.

Depending on exact airport parking locations at North Field, Taxiway 3 (T3) has potential to shorten taxi distance and time, up to about one minute (on average) on an otherwise almost 10 minute taxi (over almost 3 miles), or about a 10% reduction in taxi distance and time. Although this taxiway alignment would provide a slightly shorter taxi distance and time, it is unlikely that a time savings of just one minute over an otherwise 10 minute taxi would encourage additional compliance with noise abatement procedures. It was pointed out to the Stakeholder Advisory Committee that almost 98% of the corporate jets and large turboprops comply with the voluntary noise abatement procedures already, and those that do are not typically daytime flights.

In summary, a new taxiway parallel to Taxiway B between Taxiway B2 (i.e., south of Ron Cowan Parkway) and Taxiway T would reduce most head-to-head taxi events on Taxiway B, minimizing delay for aircraft taxiing between North Field and South Field. This taxiway would also be required to support a new terminal in this vicinity, if such a terminal is proposed and approved. However, a full new connection between North Field and South Field, as shown in Figure 5.6, does not appear to be warranted, at least in the near-term, as it does not significantly shorten taxi distance or time, and the head-to-head taxi events are solved with a new taxiway parallel to Taxiway B, as described above.

5.5 Potential New South Field Runway

Beyond 2010, Runway 11-29 will continue to experience increases in delay (although less if the two taxiway improvements described in Section 5.2.2 are implemented); as the morning departures peak continues longer into the morning and at other peak activity periods. Detailed simulation analyses were not performed beyond 2010; however, it is anticipated that delay on Runway 11-29 will increase so as to warrant additional runway capacity at South Field between 2015 and 2025. Because additional runway capacity at South Field will likely be required before the end of the long-term planning horizon in the master plan (2025), Figure 5.7 was prepared showing five potential new runways at South Field, one inboard (north) of existing Runway 11-29 (Runway I1) and four outboard (south) of existing Runway 11-29 (Runways O1, O2, O3, and O4). The graphic presents planning considerations outlining the benefits and issues associated with each runway. All of the potential new runways have considerable environmental issues associated with filling wetlands and San Francisco Bay, as well as financial issues (e.g., the outboard options are expected to cost several billion dollars).

Potential New North Field–South Field Taxiway Time Comparisons

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<thead>
<tr>
<th>Taxi Route</th>
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</tr>
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<tbody>
<tr>
<td>Runway 11-29</td>
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<tr>
<td>Existing (Taxiway B or T0)</td>
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<tr>
<td>Taxiway 2 (T2)</td>
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</tr>
<tr>
<td>Taxiway 3 (T3)</td>
<td>-71% -12% -7% -1% -55% -10%</td>
</tr>
<tr>
<td>Taxiway 4 (T4)</td>
<td>0% 0% 179% 36% 0% 0%</td>
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(1) A positive number/percentage represents an increase in taxi time compared to existing, and a negative number/percentage represents a decrease in taxi time compared to existing

Potential New North Field–South Field Runway

Beyond 2010, Runway 11-29 will continue to experience increases in delay (although less if the two taxiway improvements described in Section 5.2.2 are implemented); as the morning departures peak continues longer into the morning and at other peak activity periods. Detailed simulation analyses were not performed beyond 2010; however, it is anticipated that delay on Runway 11-29 will increase so as to warrant additional runway capacity at South Field between 2015 and 2025. Because additional runway capacity at South Field will likely be required before the end of the long-term planning horizon in the master plan (2025), Figure 5.7 was prepared showing five potential new runways at South Field, one inboard (north) of existing Runway 11-29 (Runway I1) and four outboard (south) of existing Runway 11-29 (Runways O1, O2, O3, and O4). The graphic presents planning considerations outlining the benefits and issues associated with each runway. All of the potential new runways have considerable environmental issues associated with filling wetlands and San Francisco Bay, as well as financial issues (e.g., the outboard options are expected to cost several billion dollars).

5.5 Potential New South Field Runway

Beyond 2010, Runway 11-29 will continue to experience increases in delay (although less if the two taxiway improvements described in Section 5.2.2 are implemented); as the morning departures peak continues longer into the morning and at other peak activity periods. Detailed simulation analyses were not performed beyond 2010; however, it is anticipated that delay on Runway 11-29 will increase so as to warrant additional runway capacity at South Field between 2015 and 2025. A high-level approximation of runway capacity and delay was prepared using the Annual Service Volume (ASV) methodology outlined in FAA AC No. 150/5060-5, Airport Capacity and Delay (see Appendix J).

Because additional runway capacity at South Field will likely be required before the end of the long-term planning horizon in the master plan (2025), Figure 5.7 was prepared showing five potential new runways at South Field, one inboard (north) of existing Runway 11-29 (Runway I1) and four outboard (south) of existing Runway 11-29 (Runways O1, O2, O3, and O4). The graphic presents planning considerations outlining the benefits and issues associated with each runway. All of the potential new runways have considerable environmental issues associated with filling wetlands and San Francisco Bay, as well as financial issues (e.g., the outboard options are expected to cost several billion dollars).

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(1) A positive number/percentage represents an increase in taxi time compared to existing, and a negative number/percentage represents a decrease in taxi time compared to existing

In accordance with various settlement agreements with the surrounding communities, the Port has agreed not to construct any new runways in any portion of North Field. The Port has also agreed not to enlarge, lengthen, widen, or strengthen the runways of accommodating large or heavy aircraft through the existing runways on North Field unless such improvements are necessary to maintain Runway 6-24, as an alternate runway to Runway 11-29 on such improvements are necessary to comply with FAA standards. For details, please refer to the relevant settlement agreements.
Therefore, it is recommended that the Port not pursue a new South Field runway at this time due to environmental and financial constraints. However, it is recommended that the Port work with its regional partners (e.g., the Regional Airport Planning Committee, the San Francisco Bay Water Transit Authority) to continue discussions about the future demand and capacity of runways at Bay Area airports and possible alternatives. Providing additional runway capacity for the Bay Area should be discussed and decided by the entire region. For example, other options for providing additional Bay Area runway capacity could include air service development at other regional or military airports, or exploring the possibility of linking OAK and San Francisco International Airport with passenger ferry service (see discussion of ferry service in Section 4.6.5, which highlights some of the challenges associated with ferry service at OAK).

The Stakeholder Advisory Committee discussion about new runway capacity at South Field was mixed. Most members preferred not to discuss the need for new runway capacity in the long-term; others saw some potential airport noise reduction with the outboard runway options (Runways O1, O2, O3, and O4 in Figure 5.7).

### 5.6 Remote Remain Overnight (RON) Aircraft Parking

The need for future remote (off-gate, on-Airport) RON aircraft parking apron was evaluated. Remote RON aircraft parking demand at OAK is considerable. Because OAK is a west coast spoke (as opposed to hub) airport, many airlines want to park their aircraft overnight so that they can start the next day at OAK with an early morning departure (typically between 6 and 8 AM). Further, the largest airline at OAK, Southwest Airlines, has a crew base at OAK, increasing the number of aircraft needing to be parked overnight for early morning departures. It should also be noted that currently, Southwest Airlines does not fly their aircraft through the night (i.e., on red-eye flights), but parks them for maintenance and servicing. For the purposes of the master plan, remote RON aircraft parking apron is described in terms of area (acres), as opposed to the number of aircraft parking positions.

In February 2005, there were 26 acres of apron dedicated to RON aircraft parking, of which 21 acres was in use on any given night. After the Terminal 2 renovation/extension project is complete, there will be approximately 33 acres of apron dedicated to RON aircraft parking, of which 23 to 26 acres is anticipated to be required on any given night. As new aircraft gates are constructed at OAK, RON aircraft parking will continue to be required. However, less apron area per gate may need to be dedicated to RON, as more aircraft will be able to park overnight at aircraft gates (rather than on remote RON aprons). It is anticipated that additional gate construction would allow the gate-use intensity to decrease such that it will not be required to push an aircraft off a gate for a subsequent arrival (i.e., it can remain parked on the gate until its morning departure and the later arrival can use its own gate and also remain there until morning).

The first step to estimate future remote RON aircraft parking requirements is to develop appropriate planning factors. As of February 2005, between 0.8 and 0.9 acres of remote RON aircraft parking apron per aircraft gate is required depending on the number of aircraft gates that are also used for RON aircraft parking (90% vs. 70%, respectively). Based on RON aircraft parking data from McCarran (Las Vegas) International Airport (a large, west-coast airport with Southwest Airlines operations), the anticipated reduction in remote RON aircraft parking demand due to the availability of aircraft gates could result in requirements closer to 0.5 acres of remote RON aircraft parking apron per aircraft gate. Using this data, low (0.5 acres per aircraft gate), medium (0.8 acres per aircraft gate), and high (0.9 acres per aircraft gate) requirements are then calculated for the 2010 to 2025 timeframe (with 46 to 50 total aircraft gates) and 2025 timeframe (with 65 to 75 total aircraft gates). As shown in Table 5.2, the required area for remote RON aircraft parking aprons ranges from about 23 acres to 46 acres in the 2010 to 2012 timeframe and from about 33 to 68 acres in the 2025 timeframe.

<table>
<thead>
<tr>
<th>Total Aircraft Gates</th>
<th>Total RON Aircraft Parking (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>Low (1) 23</td>
</tr>
<tr>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>65</td>
<td>33</td>
</tr>
<tr>
<td>75</td>
<td>38</td>
</tr>
</tbody>
</table>

(1) Assumes the gate to remote RON aircraft parking ratio will decrease in the future; (2) Assumes existing gate to remote RON aircraft parking ratio with 10% of gates not used for RON aircraft parking; (3) Assumes existing gate to remote RON aircraft parking ratio with 30% of gates not used for RON aircraft parking.

Providing the required amount of remote RON aircraft parking will be challenging, as shown in Figure 5.8. All areas except Area 1 require wetlands to be filled/impacted. Providing remote RON aircraft parking in Area 1 will be challenging, because potential future terminal concepts in this area likely eliminate existing remote RON aircraft parking aprons. Planning considerations for each potential area are shown on Figure 5.8.
Figure 5.1

Master Plan 2010 Forecast — Runway 29 Operations

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Planning Considerations
• Provides additional aircraft queuing area for Runway 29
• Provides greater aircraft sequencing capabilities
• Negates the need for midfield take-offs
• Impacts wetlands (approximately 1.6 Acres)
• Reduces Runway 29 queuing by 23% (39% with new high-speed exit taxiway)

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan assessed many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (or right) imposed or view concept that was discarded, and must be interpreted in the context of the entire master plan document.
Planning Considerations

- Reduces Runway Occupancy Time (ROT) (approximately 13%)
- Impacts wetlands (approximately 1.2 Acres)
- Decreases taxi distances and time (approximately 9%)
- Reduces airfield congestion
- Reduces Runway 29 queue delay by 21% (39% with new Runway 29 access)

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not purport any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Airfield Queue Delay Comparison

Master Plan 2010 Forecast — Runway 29 Queue Delay Comparison

- **Baseline**
- **With new High-Speed Exit Taxiway**
- **With new Runway 29 Access**
- **With new High-Speed Exit Taxiway and Runway 29 Access combined**

**Legend**

- **March 2006**
- **Oakland International Airport Master Plan**
- **Figure 5.4**

**Average Delay per Aircraft (min)**

**Time of Day (hr)**

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Planning Considerations

- Minimizes runway crossings (improves safety) for aircraft landing at North Field that need to taxi to South Field (e.g., passenger airlines that land at North Field when Runway 11-29 is closed)
- Provides a shorter taxi route (distance and time) for aircraft landing at North Field that need to taxi to South Field (Runway 9R-27L is a designated air carrier alternate runway and used when Runway 11-29 is closed)
- Allows for more taxiway redundancy for extended maintenance activities (e.g., when Runway 11-29 needs to be overlaid in the future)
- Provides a more standard airfield layout for North Field
- Difficult/expensive construction (e.g., poor soil and drainage conditions)

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and is not a planning purview nor does it represent any particular course of action (it might represent an idea or concept that was discarded) and must be interpreted in the context of the entire master plan document.
This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examines many possible ideas and planning concepts. This graphic is conceptual in nature and is for planning purposes only. It does not represent any particular source of action (i.e., it might appear as ideas or concepts that were discarded), and must be interpreted in the context of the entire master plan document.

Note:

- **Taxiway 0**
  - Allows aircraft taxiing to South Field to bypass the departure queue for Runways 27L and 27R (improves airfield flow)
  - Merges with Taxiway B north of the bridge over Ron Cowan Parkway, negating the need to construct a new (second) taxiway bridge over Ron Cowan Parkway
  - Does not impact wetlands
  - Provides more standard airfield layout (compared to existing Taxiway A)
  - May not be required if a new taxiway parallel to and east of Taxiway B is constructed south of the Oakland Maintenance Center site (to Taxiway T)

- **Taxiway 1**
  - Provides additional taxiway connection between North Field and South Field
  - Improves airfield flow and minimizes head-to-head aircraft operations on Taxiway B
  - Provides taxiway access to Central Basin
  - Of Central Basin options (T1, T2, and T4), minimizes impact to wetlands (13 acres of wetland impact)
  - Requires a portion of Ron Cowan Parkway to be reconstructed below grade with a difficult connection to Harbor Bay Parkway
  - Provides relatively long taxi distances for corporate jets taxiing from North Field to depart South Field on Runway 29
  - Moves taxing aircraft closer to the City of Alameda
  - Expansive construction (i.e., large amount of fill, grading, soil preparation, environmental/wetlands mitigation)
  - May not be required if a new taxiway parallel to and east of Taxiway B is constructed south of the Oakland Maintenance Center site (to Taxiway T)

- **Taxiway 2**
  - Provides additional taxiway connection between North Field and South Field
  - Improves airfield flow and minimizes head-to-head aircraft operations on Taxiway B
  - Provides taxiway access to Central Basin
  - Requires large wetlands impact (10 acres ±)
  - Expansive construction (i.e., large amount of fill, grading, soil preparation, environmental/wetlands mitigation)
  - May not be required if a new taxiway parallel to and east of Taxiway B is constructed south of the Oakland Maintenance Center site (to Taxiway T)

- **Taxiway 3**
  - Provides additional taxiway connection between North Field and South Field, connecting to Taxiway B and a new taxiway parallel to and east of Taxiway B
  - Improves airfield flow and minimizes head-to-head aircraft operations on Taxiway B
  - Requires motor wetlands impact (2 acres ±)
  - Requires a portion of Ron Cowan Parkway to be reconstructed below grade in proximity to existing Taxiway B bridge over Ron Cowan Parkway undercrossing
  - May not be required if a new taxiway parallel to and east of Taxiway B is constructed south of the Oakland Maintenance Center site (to Taxiway T)

- **Taxiway 4**
  - Provides additional taxiway connection between North Field and South Field
  - Improves airfield flow and minimizes head-to-head aircraft operations on Taxiway B
  - Provides taxiway access to Central Basin
  - Requires large wetlands impact (27 acres ±)
  - Expansive construction (i.e., large amount of fill, grading, soil preparation, environmental/wetlands mitigation)
  - May not be required if a new taxiway parallel to and east of Taxiway B is constructed south of the Oakland Maintenance Center site (to Taxiway T)
Planning Considerations

Runway 21 (700 ft. Inboard of Runway 11-29)
- Provides an increase in runway capacity during visual meteorological conditions (VMC).
- Allows for paired, simultaneous departures if (1) divergent headings (15 degrees or more) are available and (2) the two departing aircraft do not need to turn in the same direction.
- Allows one runway to be used for arriving aircraft and the other runway to be used for departing aircraft, eliminating the need to preserve gaps for disparate operations.
- Moves aircraft arriving or departing Runway 21 closer to residential areas in San Leandro or Alameda (respectively, in West Plan).
- Minimizes aircraft queuing distance available between terminal area and Runway 25, further congesting the terminal area.
- Requires demolition or relocation of the Ground Run-up Enclosure (GRE).
- Possible wake turbulence concerns (may limit simultaneous operations even in VMC).
- Slightly easier/less expensive construction over existing Taxiway W (formerly temporary Runway 12-30).
- Does not require Bay Fill.
- Impacts wetlands (over 100 acres).
- Impacts Bay waters (over 150 acres in total impacted footprint).
- Impacts OPS/FAA requirements.
- Expensive/difficult construction.

Runway O1 (800 ft. Outboard of Runway 11-29)
- Operates similar to potential Runway 11, without impacting aircraft queuing.
- Moves aircraft arriving or departing Runway O1 farther away from residential areas in San Leandro or Alameda (respectively, in West Plan).
- Impacts Bay waters (over 150 acres in total impacted footprint).
- Impacts wetlands (over 40 acres).
- Expensive/difficult construction.

Runway O2 (2,500 ft. Outboard of Runway 11-29)
- Allows independent (paired) simultaneous operations (take-offs and landings) without wake turbulence concerns in VMC.
- Allows for independent simultaneous arrivals to one runway and departures from the other runway in instrument meteorological conditions (IMC).
- Allows for staggered (not simultaneous) paired arrivals in IMC.
- Provides a moderate to substantial increase in runway capacity in VMC and IMC conditions (and associated reduction in delay).
- May be able to use new GPS-based technologies to further improve runway capacity (e.g., allowing for paired, simultaneous arrivals).
- Possible airspace interaction issues with arrivals to San Francisco International Airport (SFO).
- Moves aircraft arriving or departing Runway O2 farther away from residential areas in San Leandro or Alameda (respectively, in West Plan).
- Impacts Bay waters (over 550 acres in total impacted footprint).
- Impacts wetlands (over 4 acres for taxiway connections).
- Expensive/difficult construction.

Runway O3 (3,400 ft. Outboard of Runway 11-29)
- Allows independent (paired) simultaneous operations in VMC and IMC with special radar equipment to monitor arriving and departing aircraft.
- Provides a substantial increase in runway capacity in VMC and IMC conditions (and associated reduction in delay).
- Moves aircraft arriving or departing Runway O3 farther away from residential areas in San Leandro or Alameda (respectively, in West Plan).
- Possible airspace interaction issues with arrivals to SFO.
- Impacts Bay waters (over 1,000 acres in total impacted footprint).
- Impacts wetlands (over 4 acres for taxiway connections).
- Expensive/difficult construction.

Runway O4 (4,300 ft. Outboard of Runway 11-29)
- Operates similar to Runway O3, without special radar equipment.
- Impacts Bay waters (over 1,100 acres in total impacted footprint).
- Impacts wetlands (over 4 acres for taxiway connections).
- Expensive/difficult construction.

Runway 11-29 Extension
- Extends Runway 11-29 by 1,600 ft to a total length of 11,600 feet, including runway safety areas.
- Would require associated taxiway extensions.
- May require the runway be shifted 500 feet farther west to provide a full runway safety area on approach to Runway 29 (not shown).
- Does not increase runway capacity.
- Allows large cargo aircraft to depart with heavier loads on longer flights (e.g., air cargo flights to Asia).
- Provides limited or no benefit to passenger airline operations.
- Somewhat expensive/difficult construction.
- Likely does not provide enough/benefit compared to probable costs.

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Planning Considerations

Area 1 (Terminal Area)
- Provides RON aircraft parking around the perimeter of taxiways, terminals, buildings, etc. (areas not used for other terminal area functions)
- Provides RON aircraft parking in proximity to gates, with no taxiway crossings
- Competes for area for other terminal area functions, such as automobile parking
- Area available for RON aircraft parking depends on future terminal concept (some concepts allow for more RON aircraft parking area, some less)

Area 2
- Provides approximately 11 acres for RON aircraft parking
- Impacts wetlands
- Must use/cross active taxiways when repositioning aircraft between RON parking positions and gates

Area 3
- Provides approximately 20 acres for RON aircraft parking
- Impacts wetlands
- Must use/cross active taxiways when repositioning aircraft between RON parking positions and gates
- May be affected by new South Field runway and associated taxiway system

Area 4
- Provides approximately 28 acres for RON aircraft parking
- Impacts wetlands
- Impacts a major storm water drainage basin
- May avoid the need to use/cross active taxiways when repositioning aircraft between RON parking positions and gates
- May be affected by new taxiways to improve access to Runway 29
- May not be feasible due to airspace height restrictions

Area 5
- Provides approximately 9 acres for RON aircraft parking
- Possible impacts to wetlands (depending on the exact size and shape of the area)
- Must use/cross active taxiways when repositioning aircraft between RON parking positions and gates
- May be affected by new taxiways to improve access to Runway 29
- May impact/limit possible future expansion of Federal Express (Area 3 from graphic showing Potential Air Cargo Development Areas)

North Field (not shown)
- Significant area available to develop RON aircraft parking
- Long reposition distances on taxiways between North Field and gates (inefficient for airline operations)
- May be used to reduce delay on Taxiway B

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Chapter 6: Environmental Considerations

“How long can men thrive between walls of brick, walking on asphalt pavements, breathing the fumes of coal and of oil, growing, working, dying, with hardly a thought of wind, and sky, and fields of grain, seeing only machine-made beauty, the mineral-like quality of life?”

— Charles A. Lindbergh, Reader’s Digest, November 1939

6.1 Introduction

This chapter presents screening-level analyses for potential environmental effects of the aircraft operations forecasts and potential master plan projects discussed in Chapters 3 through 5. It is important to note that there may or may not be a correlation between potential master plan projects and the number of aircraft operations. That is, in some cases, potential projects might reduce or at least not increase the number of aircraft operations, or aircraft operations might occur in any event, even if some of the potential master plan projects are not constructed.

This chapter has the following five sections:

- Wetlands (Section 6.2)
- Aircraft Noise (Section 6.3)
- Other Airport Environmental Programs and Policies (Section 6.4)
- Preliminary Environmental Screening Matrix (Section 6.5)
- Community-Requested Environmental Projects (Section 6.6)

The analyses presented in this chapter have been prepared in accordance with FAA AC No. 150/5070-6A. The AC states that the two essential components of environmental analysis in the OAK master plan, the following principle, as outlined in the AC, was used: “The information presented in this AC covers the planning requirements for all airports, regardless of size, complexity, or role. However, the scope of study must be tailored to the individual airport, with the level of effort limited to its specific needs and problems. Based on an airport’s specific needs, certain master planning elements may be emphasized while others will not be considered at all.”

As a concept-level planning and feasibility study, the OAK master plan focuses on short-term planning strategies and long-term planning principles, not specific airport projects or facilities. If and when any possible development contemplated in the OAK master plan should ripen into a project that the Port may wish to pursue and approve, the Port will follow all environmental regulations and permit requirements required of specific project-level planning, including environmental review in accordance with the National Environmental Policy Act (NEPA) and/or the California Environmental Quality Act (CEQA).

As such, when it considers approval of the OAK master plan, the Board of Port Commissioners will not be deciding to propose or approve any specific project or groups of projects. Rather, any project identified in the OAK master plan would need to undergo more detailed planning, engineering and environmental review before it could proceed, including understanding how much it might cost, how it is going to be funded, and importantly, its environmental effects (through a CEQA and NEPA process). Only then could a project or groups of related projects be approved by the Board and proceed into construction. For additional discussion on environmental considerations in the master plan, see Appendix K.

6.2 Wetlands

Figure 6.1 shows the wetlands and other water bodies on the Airport that are under jurisdiction of the U.S. Army Corps of Engineers. According to the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency, wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. As described in Figure 2.2, there are approximately 327 acres of jurisdictional wetlands, the majority of which are located on South Field in the Central Basin and around Runway 11-29.

The list of planning considerations for each of the potential development areas (Chapter 3) and the potential airfield development (Chapter 4) noted if the potential development would likely impact on Airport wetlands. If a potential project that impacts wetlands were to proceed, the Port would need to obtain permits to fill the wetlands and would be required to mitigate the effects by replacing wetlands at another (preferably off-Airport) location. It is important to note that while wetlands are environmentally beneficial and, in some locations on the Airport, serve an important drainage function (e.g., filtering storm water runoff), they also attract birds, which can pose a serious safety hazard to aircraft operations.

6.3 Aircraft Noise

This section presents background on aircraft noise (Sections 6.3.1 through Section 6.3.5), discusses existing aircraft noise control programs at OAK (Section 6.3.6), and presents the results of aircraft noise modeling, which compares existing (2004) aircraft noise contours with anticipated 2010 aircraft noise contours, assuming the aircraft operations forecasts developed in Chapter 3 (Sections 6.3.7 through 6.3.9).
6.3.1 Background

This section presents background information on the characteristics of noise. Noise analyses involve the use of technical terms that are used to describe aviation noise. This section provides an overview of the metrics and methodologies used to assess the effects of noise.

Characteristics of Sound

Sound Level and Frequency — Sound can be technically described in terms of the sound pressure (amplitude) and frequency (similar to pitch). Sound pressure is a direct measure of the magnitude of a sound without consideration for other factors that may influence its perception. The range of sound pressures that occur in the environment is so large that it is convenient to express these pressures as sound pressure levels on a logarithmic scale that compresses the wide range of sound pressures to a more usable range of numbers. The standard unit of measurement of sound is the Decibel (dB) that describes the pressure of a sound relative to a reference pressure.

The frequency (pitch) of a sound is expressed as Hertz (Hz) or cycles per second. The normal audible frequency for young adults is 20 Hz to 20,000 Hz. Community noise, including aircraft and motor vehicles, typically ranges between 50 Hz and 5,000 Hz. The human ear is not equally sensitive to all frequencies, with some frequencies judged to be louder for a given signal than others. See Figure 6.2. As a result of this, various methods of frequency weighting have been developed. The most common weighting is the A-weighted noise curve (dBA). The A-weighted decibel scale (dBA) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. In the A-weighted decibel, everyday sounds normally range from 30 dBA (very quiet) to 100 dBA (very loud). Most community noise analyses are based upon the A-weighted decibel scale. Figure 6.3 shows the A-weighted scale compared to other scales such as the C-weighted scale, which is more sensitive to low frequency noise and used in assessing hearing loss in occupational or recreational exposures to noise. The C-weighted scale has also been used to quantify low frequency noise in the environment, but such use is crude and can be misleading. Changes in C-weighted scale noise do not mean changes in low frequency noise. The C-weighted scale also measures higher frequency sounds, and therefore a change in the C-weighted scale measurement could be due to low or high frequency sounds. If low frequency noise impacts are to be identified, measurements in frequency bands are the best method of defining low frequency noise.

Sources of Aircraft Noise — The noise generated by an aircraft flight is quite complex. The sound sources can be described in four broad categories: jet noise (the mixing of high velocity exhaust gases with ambient air), combustor noise (the noise associated with the rapid oxidation of jet fuel and the associated release of energy), turbomachinery noise (often noticed as an aircraft is coming towards you), and aerodynamic noise (the noise associated with rapid air movement over the airframe and control surfaces). New technologies in modern aircraft have achieved significant reductions in jet noise and combustor noise. Turbomachinery noise has also been reduced in newer aircraft. Aerodynamic noise is a current area of acoustic research to reduce aircraft noise. As jet noise, combustor noise and turbomachinery noise are reduced, aerodynamic noise may remain as the major noise source on aircraft of the future.

Propagation of Noise — Outdoor sound levels decrease as the distance from the source increases, and as a result of wave divergence, atmospheric absorption and ground attenuation. Sound radiating from a source in a homogeneous and undisturbed manner travels in spherical waves. As the sound wave travels away from the source, the sound energy is dispersed over a greater area decreasing the sound power of the wave. Spherical spreading of the sound wave reduces the noise level at a rate of 6 dB per doubling of the distance.

Atmospheric absorption also influences the levels received by the observer. The greater the distance traveled, the greater the influence of the atmosphere and the resultant fluctuations. Atmospheric absorption becomes important at distances of greater than 1,000 feet. The degree of absorption varies depending on the frequency of the sound as well as the humidity and temperature of the air. For example, atmospheric absorption is lowest (i.e., sound carries farther) at high humidity and high temperatures. Schematic atmospheric effects diagrams are presented in Figure 6.4. Turbulence and gradients of wind, temperature and humidity play a significant role in determining the propagation of sound over a large distance. At short distances between the source and receiver, atmospheric effects are minimal. Certain conditions, such as inversions, can channel or focus the sound waves resulting in higher noise levels than would result from simple spherical spreading. Absorption effects in the atmosphere vary with frequency. The higher frequencies are more readily absorbed than the lower frequencies. Over large distances, the lower frequencies become the dominant sound as the higher frequencies are attenuated. The effect of sound reflecting across a water surface has an even more profound effect than weather. Sound propagating over water is louder than propagating over land as the result of the reflective characteristics of water. Shielding of noise by a structure also can have significant effects on noise. Structures such as buildings, homes, sound walls, etc., block the straight line propagation of sound. Homes shielded by these structures receive a lower noise level than without the intervening structures.
Duration of Sound — Annoyance from a noise event increases with increased duration of the noise event (i.e., the longer the noise event, the more annoying it is). The "effective duration" of a sound is the time between when a sound rises above the background sound level until it drops back below the background level. Psycho-acoustic studies have determined the relationship between duration and annoyance and the amount a sound must be reduced to be judged equally annoying for increased duration. Duration is an important factor in describing sound in a community setting.

The relationship between duration and noise level is the basis of the equivalent energy principal of sound exposure. Reducing the acoustic energy of a sound by one half results in a 3 dB reduction. Doubling the duration of the sound increases the total energy of the event by 3 dB. This equivalent energy principal is based upon the premise that the potential for a noise to impact a person is dependent on the total acoustical energy content of the noise. Defined in Section 6.3.2, noise metrics such as CNEL, DNL, Leq and SEL are all based upon the equal energy principle.

Change in Noise — The concept of change in ambient sound levels can be understood with an explanation of the hearing mechanism's reaction to sound. The human ear is a far better detector of relative differences in sound levels than absolute values of levels. Under controlled laboratory conditions, listening to a steady unwavering pure tone sound that can be changed to slightly different sound levels, a person can just barely detect a sound level change of approximately 1 decibel for sounds in the mid-frequency region. When ordinary noises are heard, a young healthy ear can detect changes of two to 3 decibels. A 5 decibel change is readily noticeable while a 10 decibel change is judged by most people as a doubling or a halving of the loudness of the sound. It is typical in environmental documents to consider a 3 dB change as potentially discernable.

6.3.2 Sound Rating Scales

The description, analysis, and reporting of community sound levels is made difficult by the complexity of human response to sound and myriad of sound-rating scales and metrics developed to describe acoustic effects. Various rating scales approximate the human subjective assessment to the "loudness" or "noisiness" of a sound. Noise metrics have been developed to account for additional parameters such as duration and cumulative effect of multiple events.

Noise metrics are categorized as single event metrics and cumulative metrics. Single event metrics describe the noise from individual events, such as one aircraft flyover. Cumulative metrics describe the noise in terms of the total noise exposure throughout the day. Noise metrics used in this study are summarized below.

Single Event Metrics

Frequency Weighted Metrics (dBA) — In order to simplify the measurement and computation of sound loudness levels, frequency weighted networks have obtained wide acceptance. The A-weighting (dBA) scale has become the most prominent of these scales and is widely used in community noise analysis. Its advantages are that it has shown good correlation with community response and is easily measured. The metrics used in this study are all based upon the dBA scale.

Maximum Noise Level — The highest noise level reached during a noise event is called the "Maximum Noise Level," or Lmax. For example, as an aircraft approaches, the sound of the aircraft begins to rise above ambient noise levels. The closer the aircraft gets, the louder it is until the aircraft is at its closest point directly overhead. Then as the aircraft passes, the noise level decreases until the sound level again settles to ambient levels. Such a history of a flyover is plotted at the top of Figure 6.5. It is this metric to which people generally instantaneously respond when an aircraft flyover occurs.

Single Event Noise Exposure Level (SENEL) or Sound Exposure Level (SEL) — Another metric that is reported for aircraft flyovers is the Sound Exposure Level (SEL). This metric is essentially equivalent to the metric Single Event Noise Exposure Level (SENEL). It is computed from dBA sound levels. Referring to Figure 6.5, the shaded area, or the area within 10 dB of the maximum noise level, is the area from which the SEL is computed. The SEL value is the integration of all the acoustic energy contained within the event. Speech and sleep interference research can be assessed relative to Sound Exposure Level data.

The SEL metric takes into account the maximum noise level of the event and the duration of the event. For aircraft flyovers, the SEL value is typically about 10 dBA higher than the maximum noise level. Single event metrics are a convenient method for describing noise from individual aircraft events. This metric is useful in that airport noise models contain aircraft noise curve data based upon the SEL metric. In addition, cumulative noise metrics such as Leq, CNEL and DNL can be computed from SEL data.

Cumulative Metrics

Cumulative noise metrics assess community response to noise by including the loudness of the noise, the duration of the noise, the total number of noise events, and the time of day these events occur into one single number rating scale.

Equivalent Noise Level (Leq) — Leq is the sound level corresponding to a steady-state A-weighted sound level containing the same total energy as several SEL events during a given sample period. Leq is the "energy" average noise level during the time period of the sample. It is based on the observation that the potential for noise annoyance is dependent on the total acoustical energy content of the noise. This is
Leq can be measured for any time period, but is typically measured for 15 minutes, 1 hour, or 24 hours. Leq for a 1-hour period is used by the Federal Highway Administration for assessing highway noise impacts. Leq for 1 hour is called Hourly Noise Level (HNL) in the California Airport Noise Regulations and is used to develop Community Noise Equivalent Level (CNEL) values for aircraft operations.

Community Noise Equivalent Level (CNEL) — CNEL is a 24-hour, time-weighted energy average noise level based on the A-weighted decibel. It is a measure of the overall noise experienced during an entire day. The term “time-weighted” refers to the penalties attached to noise events occurring during certain sensitive time periods. In the CNEL scale, noise occurring between 7 PM and 10 PM is penalized by approximately 3 dB. This penalty accounts for the greater potential for noise to cause communication interference during these hours, as well as typically lower ambient noise levels during these hours. Noise that takes place during the night (10 PM to 7 AM) is penalized 10 dB. This penalty was selected to attempt to account for the higher sensitivity to noise in the nighttime and the expected further decrease in background noise levels that typically occur in the nighttime.

CNEL is graphically illustrated in the bottom of Figure 6.6. Another way to think of a cumulative noise metric like CNEL is to compare CNEL to a “noise bucket.” Each single event noise event contributes to the overall “noise bucket.” An event during evening hours counts as 3 events and an event at night counts as 10 events. This is shown schematically in Figure 6.7. Examples of various noise environments in terms of CNEL are presented in Figure 6.8. CNEL is specified for use in the California Airport Noise Regulations and is used by local planning agencies in their General Plan Noise Element for land-use compatibility planning.

Day Night Noise Level (DNL) — The DNL index is very similar to CNEL but does not include the evening (7 PM to 10 PM) penalty that is included in CNEL. It does however include the nighttime (10 PM to 7 AM) penalty. Typically DNL is about 1 dB lower than CNEL, although the difference may be greater if there is an abnormal concentration of noise events in the 7 AM to 10 PM time period. DNL is specified by the FAA for airport noise assessment and by the Environmental Protection Agency (EPA) for community noise and airport noise assessment. The FAA guidelines (described later) allow for the use of CNEL as a substitute to DNL.

### 6.3.3 Factors Influencing Individual Annoyance to Noise

#### 6.3.3.1 To Sound

Many factors influence sound perception and annoyance. This includes not only physical characteristics of the sound but also secondary influences such as sociological and external factors. Molino, in the Handbook of Noise Control, describes human response to sound in terms of both acoustic and non-acoustic factors. These factors are summarized in Table 6.1.

Sound rating scales are developed in reaction to the factors affecting human response to sound. Nearly all of these factors are relevant in describing how sounds are perceived in the community. Many non-acoustic parameters play a prominent role in affecting individual response to noise. Fields, in his analysis of the effects of personal and situational variables on noise annoyance, has identified a clear association of reported annoyance and various other perceptions or beliefs. In particular, Fields stated: “There is therefore firm evidence that noise annoyance is associated with: (1) the fear of an aircraft crashing or of danger from nearby surface transportation; (2) the belief that aircraft noise could be prevented or reduced by designers, pilots or authorities related to airlines; and (3) an expressed sensitivity to noise generally.” Thus, it is important to recognize that non-acoustic factors such as the ones described above as well as acoustic factors contribute to human response to noise.

#### 6.3.4 Effects of Noise on Humans

Noise, often described as unwanted sound, is known to have several adverse effects on humans. From these known adverse effects of noise, criteria have been established to help protect the public health and safety and prevent disruption of certain human activities. These criteria are based on effects of noise on people such as hearing loss (not a factor with typical community noise), communication interference, sleep interference, physiological responses, and annoyance. Each of these potential noise impacts on people are briefly discussed in the following narrative.

### Table 6.1: Factors That Affect Individual Annoyance to Noise

<table>
<thead>
<tr>
<th>Primary Acoustic Factor</th>
<th>Secondary Acoustic Factors</th>
<th>Non-acoustic Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound Level</td>
<td>Spectral Complexity</td>
<td>Physiology</td>
</tr>
<tr>
<td>Frequency</td>
<td>Fluctuations in Sound Level</td>
<td>Adaptation and Past Experience</td>
</tr>
<tr>
<td>Duration</td>
<td>Fluctuations in Frequency</td>
<td>How the Listener’s Activity Affects Annoyance</td>
</tr>
<tr>
<td>Rise-time of the Noise</td>
<td>Predictability of When a Noise will Occur</td>
<td></td>
</tr>
<tr>
<td>Localization of Noise Source</td>
<td>Is the Noise Necessary?</td>
<td></td>
</tr>
<tr>
<td>Individual Differences and Personality</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: C. Harris, 1979
Annoyance

Annoyance is the most difficult of all noise responses to describe. Annoyance is a very individual characteristic and can vary widely from person to person. What one person considers tolerable can be quite unbearable to another of equal hearing capability. The level of annoyance, of course, depends on the characteristics of the noise (i.e., loudness, frequency, time, and duration), and how much activity interference (e.g., speech interference and sleep interference) results from the noise. However, the level of annoyance is also a function of the attitude of the receiver. Personal sensitivity to noise varies widely. It has been estimated that 2% to 10% of the population is highly susceptible to annoyance from any noise not of their own making, while approximately 20% are unaffected by noise. Attitudes are affected by the relationship between the person and the noise source (is it our dog barking or the neighbor’s dog?). Whether we believe that someone is trying to abate the noise will also affect our level of annoyance.

Annoyance levels have been correlated to CNEL levels. Figure 6.9 relates CNEL noise levels to community response based on community response surveys. It displays the percent of a population that can be expected to be annoyed by CNEL noise exposure levels in airport related studies.

Sleep Interference

Sleep interference is a major noise concern in noise assessment and, of course, is most critical during nighttime hours. Sleep interference is one of the major causes of annoyance due to community noise. Noise can make it difficult to fall asleep, create momentary disturbances of natural sleep patterns by causing shifts from deep to lighter stages and cause awakening. Noise may even cause awakening that a person may or may not be able to recall.

Extensive research has been conducted on the effect of noise on sleep disturbance. Recommended values for desired sound levels in residential bedroom space range from 25 to 45 dBA, with 35 to 40 dBA being the norm. In 1981, the National Association of Noise Control Officials published data on the probability of sleep disturbance with various single event noise levels. Based on laboratory experiments conducted in the 1970s, this data indicated noise exposure at 75 dBA interior noise level event will cause noise induced awakening in 30% of the cases.

However, recent research from England has shown that the probability for sleep disturbance is less than what had been reported in earlier research. These recent field studies conducted during the 1990s and using new sophisticated techniques indicate that awakenings can be expected at a much lower rate than had been expected based on earlier laboratory studies. This research showed that once a person was asleep, it is much more unlikely that they will be awakened by a noise. The significance difference in the recent English study is the use of actual in-home sleep disturbance patterns as opposed to laboratory data that had been the historic basis for predicting sleep disturbance. Some of this research has been criticized because it was conducted in areas where subjects had become habituated to aircraft noise. On the other hand, some of the earlier laboratory sleep studies had been criticized because of the extremely small sample sizes of most laboratory studies and because the laboratory was not necessarily a representative sleep environment.

Hearing Loss

Hearing loss is generally not a concern in community noise problems, even very near a major airport or a major freeway. The potential for noise induced hearing loss is more commonly associated with occupational noise exposures in heavy industry, very noisy work environments with long term exposure, or certain very loud recreational activities such as target shooting, motorcycle or car racing, etc. The Occupational Safety and Health Administration (OSHA) identifies a noise expo-
sure limit of 90 dBA for 8 hours per day to protect from hearing loss (higher limits are allowed for shorter duration exposures). Noise levels in neighborhoods, even in very noisy neighborhoods, are not sufficiently loud to cause hearing loss.

Communication Interference
Communication interference is one of the primary concerns in environmental noise problems. Communication interference includes speech interference and interference with activities such as watching television. Normal conversational speech is in the range of 60 to 65 dBA and any noise in this range or louder may interfere with speech. There are specific methods of describing speech interference as a function of distance between speaker and listener and voice level.

Physiological Responses
Physiological responses are those measurable effects of noise on people that are realized as changes in pulse rate, blood pressure, etc. While such effects can be induced and observed, the extent is not known to which these physiological responses cause harm or are a sign of harm. Generally, physiological responses are a reaction to a loud short-term noise such as a rifle shot or a very loud jet overflight.

Health effects from noise have been studied around the world for nearly 30 years. Scientists have attempted to determine whether high noise levels can adversely affect human health, apart from auditory damage that is amply understood. These research efforts have covered a broad range of potential impacts from cardiovascular response to fetal weight and mortality. Yet while a relationship between noise and health effects seems plausible, it has yet to be convincingly demonstrated (i.e., shown in a manner that can be repeated by other researchers while yielding similar results).

While annoyance and sleep / speech interference have been acknowledged, health effects, if they exist, are associated with a wide variety of other environmental stressors. Isolating the effects of aircraft noise alone as a source of long-term physiological change has proved to be almost impossible. In a review of 30 studies conducted worldwide between 1993 and 1998, a team of international researchers concluded that, while some findings suggest that noise can affect health, improved research concepts and methods are needed to verify or discredit such a relationship. They called for more study of the numerous environmental and behavioral factors than can confound, mediate, or moderate survey findings. Until science refines the research process, a direct link between aircraft noise exposure and non-auditory health effects remains to be demonstrated. The World Health Organization (WHO) has made quite specific findings on the potential of environmental noise to cause health impacts:

“... cardiovascular effects are associated with long-term exposure to LAeq, 24h values in the range of 65–70 dB or more, for both air- and road-traffic noise. However, the associations are weak and the effect is somewhat stronger for ischemic heart disease than for hypertension. Other observed psychophysiological effects, such as changes in stress hormones, magnitudes levels, immunological indicators, and gastrointestinal disturbances are too inconsistent for conclusions to be drawn about the influence of noise pollution.” (Source: WHO Guidelines, Section 3.5, Cardiovascular and Physiological Effects).

In other words, the World Health Organization believes that health effects do not occur at noise levels less than 65 CNEL.

School Room Effects
Interference with classroom activities and learning from aircraft noise is an important consideration and the subject of much recent research. Studies from around the world indicate that vehicle traffic, railroad, and aircraft noise can have adverse effects on reading ability, concentration, motivation, and long term learning retention. A complicating factor in this research is the extent of background noise from within the classroom itself. The studies indicating the most adverse effects examine cumulative noise levels equivalent to 65 CNEL or higher and single event maximum noise levels ranging from 85 to 95 dBA. In other studies, the level of noise is unstated or ambiguous. According to these studies, a variety of adverse school room effects can be expected from interior noise levels equal to or exceeding 65 CNEL and/or 85 dBA SEL.

Some interference with classroom activities can be expected with noise events that interfere with speech. As discussed above, speech interference begins at 65 dBA, which is the level of normal conversation. Typical construction attenuates outdoor noise by 20 dBA with windows closed and 12 dBA with windows open. Thus some interference of classroom activities can be expected at outdoor levels of 77 to 85 dBA.

6.3.5 Noise / Land-Use Compatibility Guidelines

Noise metrics are used to quantify community response to various noise exposure levels. The public reaction to different noise levels has been estimated from extensive research on human responses to exposure of different levels of aircraft noise. Noise standards generally are expressed in terms of the DNL 24-hour averaging scale (CNEL in California) based on the A-weighted decibel. Utilizing these metrics and surveys, agencies have developed standards for assessing the compatibility of various land uses with the noise environment. There are no single event noise based land-use compatibility criteria that have been adopted by the federal government or State of California.

A summary of some of the more pertinent regulations and guidelines are presented in the following paragraphs.
Federal Aviation Administration
Federal Aviation Regulations (FAR), Part 36, “Noise Standards: Aircraft Type and Airworthiness Certification” — Originally adopted in 1960, FAR Part 36 prescribes noise standards for issuance of new aircraft type certificates. Part 36 prescribes limiting noise levels for certification of new types of propeller-driven, small airplanes as well as for transport-category, large airplanes. Subsequent amendments extended the standards to certain newly produced aircraft of older type designs. Other amendments have at various times extended the required compliance dates. Aircraft may be certificated as Stage 1, Stage 2, or Stage 3 aircraft based on their noise level, weight, number of engines and in some cases number of passengers. Stage 1 aircraft are no longer permitted to operate in the U.S. Stage 2 aircraft are being phased out of the U.S. fleet as discussed below on the Airport Noise and Capacity Act of 1990. Although aircraft meeting Part 36 standards are noticeably quieter than many of the older aircraft, the regulations make no determination that such aircraft are acceptably quiet for operation at any given airport. Stage 4 noise limits are in the process of being adopted.

Aviation Safety and Noise Abatement Act of 1979 — Further weight was given to the FAA’s supporting role in noise compatibility planning by Congressional adoption of this legislation. Among the stated purposes of this act is “To provide assistance to airport operators to prepare and carry out noise compatibility programs.” The law establishes funding for noise compatibility planning and sets the requirements by which airport operators can apply for funding. This is also the law by which Congress mandated that FAA develop an airport community noise metric that would be used by all federal agencies assessing or regulating aircraft noise. The result was DNL. Because California already had a well-established airport community noise metric in CNEL, and because CNEL and DNL are so similar, FAA expressly allows CNEL to be used in lieu of DNL in noise assessments performed for California airports. The law does not require any airport to develop a noise compatibility program.

Federal Aviation Regulations (FAR), Part 150, “Airport Noise Compatibility Planning” — As a means of implementing the Aviation Safety and Noise Abatement Act, the FAA adopted regulations on Airport Noise Compatibility Planning programs. These regulations are contained in FAR Part 150. As of part of the FAR Part 150 Noise Control Program, the FAA published noise and land-use compatibility charts to be used for land-use planning with respect to aircraft noise. An expanded version of this chart appears in FAA AC No. 150/5020-1 (dated August 5, 1983) and is provided in summary form in Figure 6.11. These guidelines represent recommendations to local authorities for determining acceptability and permissible land uses. The guidelines recommend a maximum amount of noise exposure (in terms of the cumulative noise metric DNL) that might be considered acceptable or compatible to people in living and working areas. These noise levels are derived from case histories involving aircraft noise problems at civilian and military airports and the resultant community response. Note that residential land use is deemed acceptable for noise exposures up to 65 dBLN. Recreational areas are also considered acceptable for noise levels above 65 dBLN (with certain exceptions for amphitheaters). However the FAA guidelines indicate that ultimately “the responsibility for determining the acceptability and permissible land uses remains with the local authorities.”

Airport Noise and Capacity Act of 1990 — The Airport Noise and Capacity Act of 1990 (PL 101-508, 104 Stat. 1388), also known as ANCA or the Noise Act, established two broad directives to the FAA: (1) establish a method to review aircraft noise, airport use or airport access restrictions, imposed by airport proprietors; and (2) institute a program to phase-out Stage 2 aircraft over 75,000 pounds by December 31, 1999. Stage 2 aircraft are older, noisier aircraft (Boeing 737-200, Boeing 727, and Boeing / McDonnell Douglas DC-9); Stage 3 aircraft are newer, quieter aircraft (Boeing 737-300, Boeing 757, Boeing / McDonnell Douglas MD-80/90). To implement ANCA, FAA amended Part 91 and issued a new Part 161 of the Federal Aviation Regulations. Part 91 addresses the phase-out of large Stage 2 aircraft and the phase-in of Stage 3 aircraft. Part 161 establishes a stringent review and approval process for implementing use or access restrictions by airport proprietors.

Part 91 generally required that all Stage 2 aircraft over 75,000 pounds be out of the domestic fleet by December 31, 1999. The State of Hawaii and Alaska are not affected by this regulation. The agency may, for individual cases, grant waivers through 2002. But for the most part, only Stage 3 aircraft greater than 75,000 pounds are in the domestic fleet as of that date.

Part 161 sets out the requirements and procedures for implementing new airport use and access restrictions by airport proprietors. Proprietors must use the DNL metric to measure noise effects and the Part 150 land-use guideline table, including 65 dBLN, as the threshold contour to determine compatibility, unless there is a locally adopted standard that is more stringent. CNEL is an acceptable surrogate for DNL.

The regulation identifies three types of use restrictions and treats each one differently: (1) negotiated restrictions, (2) Stage 2 aircraft restrictions, and (3) Stage 3 aircraft restrictions. Generally speaking, any use restriction affecting the number or times of aircraft operations will be considered an access restriction. Even though the Part 91 phase-out does not apply to aircraft under 75,000 pounds, FAA has determined that Part 161 limitations on proprietors’ authority applies as well to the smaller aircraft.
Negotiated restrictions are more favorable from the FAA’s standpoint, but still require unwieldy procedures for approval and implementation. In order to be effective, the agreements normally must be agreed to by all airlines using the airport.

Stage 2 restrictions are more difficult because one of the major reasons for ANCA was to discourage local restrictions more stringent than 1999 phase-out already contained in ANCA. To comply with the regulation and institute a new Stage 2 restriction, the proprietor must generally do two things: (1) prepare a cost / benefit analysis of the proposed restriction and (2) give proper notice. The cost / benefit analysis is extensive and entails considerable evaluation. Stage 2 restrictions do not require approval by the FAA.

Stage 3 restrictions are even more difficult to implement. A Stage 3 restriction involves considerable additional analysis, justification, evaluation, and financial discussion. In addition, a Stage 3 restriction must result in a decrease in noise exposure of the 65 dBA DNL to noise sensitive land uses (residences, schools, churches, parks). The regulation requires both public notice and FAA approval.

ANCA applies to all new local noise restrictions and amendments to existing restrictions proposed after October 1990.

**State of California**

**California Airport Noise Regulations** — The Aeronautics Division of the California Department of Transportation (Caltrans) enforces the California Airport Noise Regulations. These regulations establish 65 CNEL as a noise impact boundary within which there shall be no incompatible land uses. This requirement is based, in part, upon the determination in the Caltrans regulations that 65 CNEL is the level of noise which should be acceptable to “a reasonable man residing in the vicinity of an airport.” Airports are responsible for achieving compliance with these regulations. Compliance can be achieved through noise abatement alternatives, land acquisition, land-use conversion, land-use restrictions, or sound insulation of structures. Airports not in compliance can operate under variance procedures established within the regulations.

**California Noise Insulation Standards** — California Noise Insulation Standards apply to all multi-family dwellings built in the State. Single-family residences are exempt from these regulations. With respect to community noise sources, the regulations require that all multi-family dwellings with exterior noise exposure greater than 60 CNEL be sound insulated such that the interior noise level will not exceed 45 CNEL. These requirements apply to all roadway, rail, and airport noise sources.

**General Plan Requirements** — The State of California requires that all municipal General Plans contain a Noise Element. The requirements for the Noise Element of the General Plan include describing the noise environment quantitatively using a cumulative noise metric such as CNEL or DNL, establishing noise / land-use compatibility criteria, and establishing programs for achieving and/or maintaining compatibility. Noise elements shall address all major noise sources in the community including mobile and stationary sources.

**Airport Land Use Commissions** — Airport Land Use Commissions were created by State Law for the purpose of establishing a regional level of land-use compatibility between airports and their surrounding environs. The Alameda County Airport Land Use Commission has adopted an Airport Environments Land Use Plan (AELUP) for Alameda airports including OAK. The AELUP establishes noise / land-use acceptability criteria for sensitive land uses at up to 70 CNEL for outdoor areas and 45 CNEL for indoor areas of residential land uses. The Alameda standard is considerably more permissive than the standard set by the State of California or the guidelines established by the FAA.

### 6.3.6 Noise Analysis Methodology

The methods used for describing existing noise and forecasting the future noise environment rely heavily on computer noise modeling. The noise environment is commonly depicted in terms of lines of equal noise levels, or noise contours. The computer noise models used for master plan aircraft noise analyses are described below.

Noise contour modeling is a key element of the aircraft noise analyses performed for this master plan. Generating accurate noise contours is largely dependent on the use of a reliable, validated, and updated noise model. The computer model can then be used to predict the changes to the noise environment as a result of any alternatives under consideration.

For the master plan, the FAA’s Integrated Noise Model (INM) Version 6.01c was used to model aircraft operations at OAK. The INM has an extensive database of civilian and military aircraft noise characteristics, and this most recent version of INM incorporates advanced plotting features. Noise contour files from the INM were loaded into Arcview Geographic Information System (GIS) software for plotting and land-use analysis. All of the noise contours presented in this master plan were developed by Brown-Buntin Associates as a subconsultant to Mestre Greve Associates.
6.3.7 Existing Noise Control Program

The Port has adopted a comprehensive noise control program to minimize and mitigate the effects of aircraft noise. This program affects various modeling assumptions. For example, it is assumed that all elements of the Port’s existing noise control program would remain in effect through the 2010 to 2012 timeframe. This program can be described in terms of the following broad categories:

- Noise Management Measures
- Noise Abatement Procedures
- Community Outreach and Public Participation
- Community Land-Use Measures
- Noise Reduction Programs, Studies and Other Commitments

These elements of the program are described in outline form in Figure 6.12, and a detailed explanation of each program is contained in a program description from the Port’s Aviation Noise / Environmental Management Office.

6.3.8 Aircraft Single Event Noise Contours

Single event noise levels, reported here in terms of Sound Exposure Level (SEL), vary by aircraft type. Even for a given aircraft type, airlines operate at different weights depending on destination and load factor. SEL contours are presented to compare the difference in noise level that different aircraft make. Figure 6.13 and Figure 6.14 show the SEL contours for arrivals and departures to Runway 29 for a variety of the major aircraft that use this runway. In Figure 6.13, single event contours are shown for the Boeing 727 Hushkit aircraft and the narrow-body twin-engine jet aircraft, such as the Boeing 737 and Airbus A320 family. The Boeing 727 Hushkit is one of the noisiest aircraft that operates at OAK, and the scale of the map used for the Boeing 727 contour set is much smaller than the scale used for the other contour sets. The Boeing 737 and Airbus A320 families are the main workhorses for air carrier operations at OAK. Figure 6.14 shows single event contour sets for the wide-body twin-engine aircraft such as the Boeing 767 and Airbus A300 family and contour sets for the 3-engine wide-body aircraft such as the Boeing / McDonnell Douglas MD-11 and older Boeing / McDonnell Douglas DC-10. The Boeing 767 and Airbus A300 contours are important because these are the aircraft that will likely replace the noisier, aging Boeing 727 Hushkit aircraft. Figure 6.13 and Figure 6.14 include tables comparing the existing number of average daily operations in 2004 and the forecast number in 2010 for these types of aircraft. Data are provided for the day, evening, and night hours (corresponding to the CNEL time periods) for departures and arrivals. These data show a decrease in the number of operations forecast for the B727 Hushkit aircraft, and an increase in the number of operations for the newer types of aircraft.

6.3.9 Existing CNEL Noise Contours

CNEL contours for 2004 are presented in Figure 6.15. These contours were developed by Brown-Burtn Associates for the Oakland Annual Noise Report for 2004 and are reproduced here on an aerial photograph. The 65 CNEL contour, shown as a dashed blue line, encroaches on the southern edge of Bay Farm Island and the southern end of San Lorenzo near San Francisco Bay.

6.3.10 Future (2010) CNEL Noise Contours

CNEL contours for the forecast number of operations in 2010 (as developed in Chapter 3) are shown in Figure 6.16. The 2010 CNEL contours are compared with existing (2004) CNEL contours in Figure 6.17. Existing 2004 CNEL contours are shown as dashed lines, and forecast 2010 CNEL contours are shown as solid lines. The forecast 2010 CNEL contours are slightly smaller than the current (2004) contours. Because of the forecast change in the aircraft fleet mix, the contours are smaller even though the operations increase. In particular, the number of B727 Hushkit operations decrease (but are not eliminated) in 2010. It is important to note that all of the new technology aircraft being built today are quieter than the aircraft they replace. This is true for the newest members of the Boeing 737 family and particularly true for aircraft like the Boeing 777 and new Boeing 787. The transition to the newer, quieter technology aircraft is being enhanced by the lower fuel consumption of these aircraft, which provides a strong incentive for airlines to modernize their aircraft fleet.

6.4 Other Airport Environmental Programs and Policies

The Port attempts to promote a sustainable operating environment at OAK, whether looking at current day-to-day operations or forecasting future needs and requirements.

In November 2000, the Board of Port Commissioners adopted a policy directing Port staff to “implement a sustainable development strategy as an overarching principle guiding the Port of Oakland’s operations and development programs, with the goal of making the Port a sustainable public agency and business enterprise.” The November 2000 Port Sustainability Policy seeks to support all of the “Three Es”: environmental responsibility, economic vitality, and social equity. The Airport supports this policy through a variety of programs and policies that are coordinated through the Port’s Aviation Noise / Environmental Management Office and Environment and Safety Department in the Engineering Division. Environmental responsibility and stewardship is incorporated into many different aspects of Airport projects, including engineering / design, project development, environmental review, construction (contracts / plans and specifications), and monitoring (health and safety compliance).
In addition, the Airport has several on-going environmental programs at the Airport, including:

- Air Quality and Alternative Fuels
- Construction Mitigation
- Green Building and LEED Certification
- Recycling / Waste Reduction
- Water Quality
- Water and Wetlands
- Wildlife Management

Each of these environmental programs is described in more detail in the following sections, and are summarized in Figure 6.18.

The Port has received several awards for its efforts in environmental stewardship through the programs described in the following sections. For example, the Port was recognized as one of the best examples of urban sustainability at the 2005 United Nations World Environment Day conference in San Francisco. Below is a partial list of accomplishments and awards.

**Alternative Fuel Program**

- Over $1 million in grant funding was awarded for the purchase of cleaner burning fueled vehicles and supporting infrastructure at the Airport.
- Over 600,000 gasoline gallon equivalents (gge) were pumped at the OAK compressed natural gas (CNG) refueling station for the first five months of 2005.

**Airport Recycling Program**

- Over 450 tons of Airport-related material was recycled in 2004.
- Awards include Alameda County Stop Waste for recycling efforts, 2003; and Port Sustainability Award for the Airport's recycling efforts, 2003.

**Design**

- Assisted FedEx in design of the 904-kilowatt photovoltaic system atop the roof of its leased facility (installed in 2005), which is expected to fuel 80% of the 81,000 square-foot facility's energy needs.
- Awards include the Port 2003 Sustainability Awards for lighting retrofit in the terminal buildings, incorporating Green Design into the Terminal 2 renovation / extension project, and starting the “Dark Skies” program aimed at decreasing the impact of exterior lighting on the surrounding community and to conserve energy.

**Public Access and Wetlands / Habitat**

- Martin Luther King Jr. Regional Shoreline, located on Port property adjacent to the Airport, is a 1,220-acre regional shoreline offering picnicking, fishing, hiking, bicycling, boating, and bird-watching opportunities for the public.
- A bike trail on Ron Cowan Parkway has been completed, providing bike access between the Airport and Alameda.
- Oro Loma is approximately 16 acres of tidal and seasonal wetland that was created as mitigation for the Airport Development Program (ADP). It has achieved all the performance criteria established during the review and permitting process.

**Compressed Natural Gas**

OAK began incorporating alternative fuel vehicles into its fleet in 1999 because it recognized that it would contribute locally to cleaner air in the surrounding communities. OAK directed its energies towards vehicles using CNG, which are up to 95% cleaner than gas- or diesel-powered vehicles. Currently, OAK has 40 CNG vehicles in its fleet, including 11 buses that transport workers from the employee parking lot to the terminals.

In 2002, OAK and its partner, Clean Energy (formerly Pickens), opened a public access, self-service CNG station at North Field. The CNG station is always open and provides fuel to Port-owned vehicles; private ground transportation operators such as taxis, shuttle vans and limos making frequent trips to OAK; other public agencies; and the general public. The fuel station has four dispensers. As of June 2005, approximately 600,000 gallons (more accurately, gge) of fuel has been pumped compared to 430,000 gallons the previous year. With the growing popularity of this station, Clean Energy will open a second CNG station located at an off-Airport site on San Leandro Street in early 2006.

The Port’s Board of Port Commissioners passed two ordinances requiring taxis and ground transportation providers, such as door-to-door and hotel shuttles, that have two or more permits to have 50% of their fleet be powered by alternative fuel. And, through the use of incentives and grants, OAK’s alternative fuel vehicle program has been greatly expanded. To date, approxi-
mately 70% of taxis serving OAK are alternative fuel vehicles. Other ground transportation providers have converted 50% of their fleets to alternative fuel vehicles. The Port has secured two more grants to help offset the cost of purchasing 15 additional off-airport parking shuttles and five CNG AirBART shuttle buses. DHL also owns and operates four CNG delivery vans at OAK.

**Biodiesel**

Shuttles buses transporting passengers between the terminals and the rental car center at North Field are now using B20 Biodiesel, a cleaner-burning diesel fuel. The B20 Biodiesel fuel, a blend of 20% soybean-based Biodiesel and 80% diesel, is now powering the Airport’s fleet of 21 shuttle buses that serve the rental car center at North Field. The fleet averages a total of 304 trips daily between the terminal at South Field and the rental car center. Each bus has a 100-gallon fuel capacity.

B20 Biodiesel reduces the amount of harmful emissions from diesel engine vehicles into the air and is recognized as an alternative fuel by the Department of Energy and the U.S. Environmental Protection Agency. One of its major advantages is that it can be used in existing diesel engines and fuel injection equipment with little impact to operating performance.

**Rechargeable Batteries**

As the number and types of alternative fuel vehicles increase in popularity in the San Francisco Bay Area, OAK has installed a free battery charging program for travelers using the on-Airport parking lots. OAK’s electric vehicle charging stations are located in the Daily Parking, Lots A and B, and in the valet parking lot. The four charging stations have both conductive and inductive hook-ups. Additionally, OAK has introduced a fleet of 15 electric vehicles that are used by staff to monitor parking lots and roadways in an effort to reduce vehicle emissions.

**Ground Service Equipment (GSE) Alternative Fuel Program**

Most current GSE run on gasoline or diesel fuel. OAK is committed to working toward converting the entire GSE fleet to alternative fuel to mitigate for the potential increase in air emissions. The conversion of these vehicles is expected to reduce emissions at OAK. Currently, the Port is conducting an inventory of the equipment used at the Airport, as well as exploring grant opportunities to help airlines offset the cost of purchasing alternative fuel GSE.

**Solar Energy**

FedEx has implemented a solar-power energy program at the Metroplex. In 2005, FedEx installed a 904-kilowatt photovoltaic system atop the roof of its 81,000 square-foot facility that is expected to fuel 80% of the facility’s energy needs. At peak output, the system can produce the equivalent of power used by more than 900 homes during the daytime. In addition to generating electricity, the solar panels will help insulate the buildings, further reducing heating and cooling costs.

Over its expected 30-year lifespan, the system’s clean solar electricity will replace most of the fossil fuel-generated electricity that would have been purchased on the open market for the facility. Additionally, by avoiding the purchase of fossil-fuel generated electricity and implementing energy efficiency measures, this project will reduce carbon dioxide emissions by 10,800 tons over 30 years, equivalent to planting 3,000 acres of trees or removing almost 2,100 cars from California roadways.

The system will reduce demand on the utility grid and will serve as an additional source of power capacity to benefit businesses and residents of California. During periods when the energy generated by the system is greater than is needed to power the facility, the surplus energy will be transferred into the utility grid for general use.

**Ground Power and Pre-Conditioned Air Loading Bridges for Aircraft**

OAK is installing aircraft ground power and pre-conditioned air units at newly constructed and renovated terminal gates, and will also retrofit existing gates. By providing these services at the gate, aircraft will not have to use their own auxiliary power units (APUs) to generate electricity while it is parked at the gate. Because an APU is typically powered by the aircraft’s jet fuel, the installation of the new ground power and pre-conditioned air units helps to reduce air emissions associated with the use of APUs.

**Trip Reduction Program**

The Port coordinates and provides commuter information such as shuttle schedules and timing, frequency, and stopping points of public transportation providers to serve the transportation needs of Airport employees and the various tenants. The Port conducted an employee commute survey of Airport tenants and staff in April 2004.

While 87% of respondents indicated they drive to work alone, a significant number of them indicated they would, if given some incentive, consider using alternative transportation. The Port is analyzing the data and will develop a trip reduction program that will identify on-site amenities, provide travel demand recommendations, develop communication material and work with the airlines and other major tenants to provide ongoing commute program support.
AirBART

AirBART is a bus system operated by the Port that links the Coliseum BART station with Terminals 1 and 2 (BART and the Port jointly share operating revenues and costs). In fiscal year 2005, AirBART carried over 1,171,000 riders. For the past several years, AirBART has experienced a 12.5% annual increase in ridership. OAK employees receive a discount for riding AirBART and approximately 3% of the ridership is attributed to employees. As ridership grows, the Port can add additional buses to the system to increase capacity, as is done today during peak periods (e.g., the Wednesday before Thanksgiving).

Aircraft Emissions

The Port is continuing its leadership role in aviation environmental issues through its participation in a recent study on aircraft-related emissions. Currently there is little data on emissions from commercial aircraft engines in the U.S. As a result, Port staff have been involved with recent efforts to collect important aircraft emissions information. The Port agreed to host a new study that involved collecting emissions data from aircraft engines. Southwest Airlines also joined this project by volunteering its aircraft for the experiment. The FAA and the University of Missouri-Rolla are working with scientists from National Aeronautics and Space Administration (NASA) and the California Air Resources Board to conduct the study.

6.4.2 Construction Mitigation

Construction associated with maintaining and upgrading existing facilities and pavement, or building new facilities at OAK generates construction debris. The Port has implemented several programs to address this issue.

Materials Management

The Terminal 2 extension / renovation project is currently underway. Because most of the construction is taking place on already developed land, tons of recyclable construction materials are being generated. Established in 2004, the airport’s Materials Management Program (MMP) diverts from public landfills recyclable construction materials such as concrete, asphalt and rebar from this and other Port projects, and converts it into reusable material for new airport construction and maintenance projects. The MMP has designated three on-airport sites for material stockpiling and recycling, allowing for the reduction of disposal and material purchasing costs and reduction of truck emissions associated with landfill disposal of waste.

It is estimated that over the next 5 years, the MMP will recycle and reuse over 200,000 cubic yards of construction materials and will save $5 million.

Construction Mitigation

A major component of project-level environmental mitigation measures are those related to construction projects. As such, the Airport has developed a construction site inspection checklist and field-monitoring follow-up to ensure contractor compliance with those measures identified in final plans and specifications. The field visits and checklists assist the Airport staff in:

- Monitoring and tracking compliance with mitigation measures identified in the EIR,
- Enforcing compliance,
- Assessing and tracking the effectiveness of applicable measures,
- Identifying mitigation measures that may require revision,
- Making recommendations for corrective action, and
- Maintaining clear communications among all responsible parties.

6.4.3 Green Building and LEED Certification

In accordance with the Port Sustainability Policy, the Airport has incorporated green building measures into the Terminal 2 renovation / extension project that is currently under construction. Green building strives to improve design and construction practices to protect natural resources and produce buildings that last longer, cost less to operate, and provide better environments for workers or residents. The Port is using the Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ as a framework and will apply for LEED certification upon completion of the project. LEED is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. It emphasizes state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. Examples of green building measures in the project include:

- Water-efficient plumbing fixtures,
- Energy-efficient building design, lighting, heating, and cooling systems,
- Substantial recycling and salvaging of construction and demolition debris,
- Use of recycled-content and renewable building materials where feasible, and
- Use of low volatile organic compound (VOC)-emitting carpet, composite wood panels, glues, and paints.

OAK is one of the first airports in the nation to seek LEED certification.
6.4.4 Recycling / Waste Reduction

In-Terminal Recycling

With more than 8,000 Airport employees and 14 MAP traveling through OAK, there is a lot of trash generated, much of it recyclable material. On Earth Day 2002, the Port launched its recycling program to divert discarded newspapers and magazines, office paper, and aluminum and plastic beverage cans and bottles from landfills. The Port has recently enhanced it further by installing 35 new recycling stations in the terminals. These additional recycling stations are conveniently located adjacent to trash receptacles and will encourage greater recycling by identifying the types of acceptable material through visuals on the top and sides of each station. The Port is well on its way to achieving its goal of diverting over 50% of post-consumer trash from landfills through this enhancement. In 2004, the program diverted over 298 tons of material (260 tons of cardboard/fiber and 38 tons of bottles/cans) from landfills.

Food Waste Recycling

In 2004, the Port added food waste to its recycling efforts. The food waste program collects pre-consumer waste such as vegetable trimmings, coffee grounds and filters, milk cartons, cheesy pizza boxes and used paper towels from airport concessions for use as high-nutrient fertilizer in the production of organic food and fiber. Over 51 tons of food waste was diverted from the landfill in 2004.

Airline Consolidated Waste and Recycling Program

Prior to 2003, each airline contracted separately with a waste company, resulting in inefficient garbage disposal and inconsistent recycling. In 2003, the Port worked with the airlines to consolidate their waste and recycling into one coordinated program. The airlines now recycle magazines, newspapers, cardboard and bottles, diverting over 101 tons of recycling from landfills in 2004, resulting in less waste going to the landfills and about $14,000 in cost savings monthly.

Airline Pillow Recycling

OAK is one of the first airports in the nation to participate in a pillow recycling program. Normally, airline pillows are immediately disposed of following the completion of a flight. This waste goes directly into landfills. The pillow recycling program collects these pillows for use as insulation or as material in making furniture.

6.4.5 Water Quality

Storm Water Program

The Port has developed a monitoring program for Port facilities, industrial tenants, and construction contractors to raise awareness of water quality issues and assist in compliance with the State Water Resources Control Board’s industrial permit. The Port organizes workshops, conducts pollution prevention training, collects and analyzes storm water samples, and inspects approximately 40 Port and tenant facilities annually. The Port also reviews storm water regulations with contractors and assists them in the development of storm water pollution prevention plans.

6.4.6 Water and Wetlands

Oro Loma

In 1999, the Port purchased and restored a 16-acre site adjacent to the existing Oro Loma Marsh that had been diked and filled by the Oro Loma Sanitary District. Known as the Sonoma Baylands project, restoration of the 320-acre tidal wetland began in 1996 and was completed in September 2000, using clean dredge materials excavated from the Port of Oakland’s minus 42-foot harbor deepening project. Monitoring and maintenance of the project will continue through 2005, whereupon the property likely will be transferred to a resource agency.

Damon Slough

In the fall of 2004, the Port completed the enhancement and expansion of a 9-acre seasonal wetland along Damon Slough and adjacent to the existing Martin Luther King Jr. Regional Shoreline. Also, as part of this project, a 1/4-mile connection has been constructed to fill in a gap in the San Francisco Bay Trail, a planned recreational corridor that, when complete, will encircle San Francisco and San Pablo Bays with a continuous 400-mile network of bicycling and hiking trails. To date, approximately 240 miles of the alignment—over half the Bay Trail’s ultimate length—have been completed.

6.4.7 Wildlife Management

Burrowing Owl Mitigation Program

Burrowing owls are one of the many species recognized by the State of California as a “species of concern.” As such, special measures have been developed and implemented to insure that the impacts to this species are minimized. The Port has developed a plan to mitigate construction impacts to burrowing owls and their burrows, and to provide long-term maintenance of a stable burrowing owl population.

A 70-acre property in eastern Alameda County was purchased to establish an off-Airport Burrowing Owl Management Area to preserve burrowing owl habitat in perpetuity. Ownership of this property was transferred to the California Department of Fish and Game for use as burrowing owl habitat and additional money was provided by the Airport to undertake initial protection, enhancement measures, and long-term management of the property.
6.5 Preliminary Environmental Screening Matrix

A preliminary environmental screening matrix was prepared to screen the potential development areas and the aircraft operations forecasts against several environmental planning considerations. Environmental planning considerations include site planning (or footprint) considerations and operational planning considerations. The distinction between site and operational planning is important. Site planning considerations, such as aesthetics, wetlands / wildlife, and geology and soils, are used to screen the potential development of certain areas on the Airport, and operational planning considerations, such as aircraft noise and air quality, are used to screen the aircraft operations forecasts. It is important to note that the development of facilities in any particular area may or may not generate new aircraft operations, and thus may or may not have any operational planning considerations. Also, an increase in the number of aircraft operations (as forecast in Chapter 3) may or may not require additional facilities, and thus may or may not result in any site planning considerations.

Table 6.2 shows the preliminary environmental screening matrix. In all cases, the evaluation is relative to existing conditions at OAK. Each potential development area is referenced to a figure shown in Chapters 4 and 5 and is evaluated against the environmental planning criteria using the following symbols:

- Red dot (•) means that there is a potential opportunity for environmental benefit,
- Gold dot (••) means that there is a potential environmental constraint,
- Green dot (•••) means that there is no potential environmental benefit or constraint, and
- Black dot (••••) means that it is unknown (without further study) if there is an environmental benefit or constraint.

It should be noted that the preliminary environmental screening matrix presents a high-level environmental screening of potential development areas and aircraft operational forecasts, and is subject to change upon further study and environmental review (see Note on bottom of Table 6.2). This high-level environmental screening was prepared by Port staff. Also, several of the site planning considerations have already been discussed in the general planning considerations for each area (as presented on the various graphics). In fact, some of the areas have already been recommended for discontinuation from further consideration based on potential environmental constraints (e.g., potential terminal development Areas 1 and 3).

6.5.1 Site Planning Considerations

This section summarizes the site planning considerations for each potential development area.

Aesthetics

In most cases, potential development areas are not anticipated to have an aesthetic benefit or constraint. However, in the case of potential terminal development Area 3, potential remain overnight (RON) aircraft parking Area 4, potential airline support facility Areas 2 and 7, and potential roadway Area 11, it is unclear whether there would be any aesthetics constraint due to potential effects on views from the City of San Leandro (additional study would be required).

Wetlands / Wildlife

If potential development in an area is anticipated to disturb or take wetlands that are under jurisdiction of the U.S. Army Corps of Engineers, it is notated as a potential environmental constraint. It should be noted that it is, of course, possible to disturb or fill wetlands, but appropriate environmental review and permits are required, in addition to providing appropriate mitigation (e.g., restoring or creating wetlands off Airport). If potential development in an area might disturb wildlife, it is noted as an unknown benefit or constraint because appropriate wildlife surveys would need to be conducted. However, the Port is aware that potential development areas at North Field are potential habitat for burrowing owls (recognized by the State of California as a "species of concern") and would require surveys and treatment before development in these areas could proceed (along with appropriate environmental reviews, engineering, etc.). In the case of potential airline support facility Areas 4 and 6 and potential parking Area 7, it is unknown at this time whether there would be an environmental benefit or constraint because the environmental benefit or constraint would depend on the exact location of the potential development within the areas.

Historic Values

In most cases, potential development areas are not anticipated to have a benefit or constraint due to historic values of the community. However, in the case of potential general aviation development Area 4 and potential airline support facility Area 5, there may be potential effects due to some portions of North Field potentially being eligible for historic designation.

Geology and Soils

Almost all of the geology and soils at the Airport is challenging from an engineering and construction perspective. At North Field, the soil is mostly unconsolidated clays (bay mud) on top of older, consolidated clays. These soil conditions mean that significant structures (i.e., buildings) must be constructed on piles and that drainage conditions are often challenging (e.g., ground water does not percolate into the soil). Conditions at South Field are similar, except that there is usually a layer of sand over the bay mud. Significant structures (e.g., buildings) must be constructed on piles,
### Master Plan Preliminary Environmental Screening Matrix (Compared to Existing Conditions)

#### Table 6.2

<table>
<thead>
<tr>
<th>Site Planning Considerations</th>
<th>Operational Planning Considerations</th>
<th>Potential Development Areas</th>
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</thead>
<tbody>
<tr>
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<td>Air Cargo (Fig. 4.15)</td>
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<tr>
<td></td>
<td>Airline Passengers</td>
<td>Air Cargo</td>
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<td></td>
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<td>2</td>
</tr>
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<td>1</td>
</tr>
<tr>
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<td>1</td>
</tr>
<tr>
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<td>1</td>
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<tr>
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<tr>
<td>Public Access</td>
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<tr>
<td>Utilities and Service Systems</td>
<td>0</td>
<td>1</td>
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</tbody>
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#### Notes

- This is a preliminary screening-level evaluation matrix for master planning purposes only and subject to change. Preliminary evaluations in this matrix may change as projects are defined in these areas and upon further environmental reviews. In all cases, evaluations are compared to existing conditions if land where a project or group of related projects are proposed, the Port will complete more detailed environmental reviews if that time is not in accordance with the California Environmental Quality Act (CEQA).

#### Potential Considerations

- **Aircraft Noise – CNEL**: Calculated using a time-weighted cumulative noise metric (CNEL = Community Noise Equivalent Level).
- **Aircraft Noise – SEL/SENEL**: Short-term noise exposure level (SEL = Sound Exposure Level, SLENEL = Short-term Event Noise Exposure Level).

#### 2010 Activity Forecast

- **Aircraft Noise – CNEL**: 14 MAP (1 million passengers)
- **Aircraft Noise – SEL/SENEL**: 127 MAT (1 million tons)
- **Air Quality**: 138,624 aircraft operations increasing to 158,504 aircraft operations
- **Transportation/Traffic**: 2010 activity forecast

#### Footnotes

1. Some as Potential Terminal Development Area 1
2. Some as Potential Terminal Development Area 2
3. Runway 29 Access Improvements (because this potential improvement reduces taxi times, it may also improve air quality) – Fig. 5.2
4. High-Speed Exit Taxiway – Runway 29 (because this potential improvement reduces taxi times, it may also improve air quality) – Fig. 5.3
5. Million Annual Passengers (MAP)
6. Million Annual Tons (MAT)
7. CNEL = Community Noise Equivalent Level (a time-weighted cumulative noise metric)
8. SEL/SENEL = Single Event Noise Exposure Level (a single aircraft overflight noise metric)
but drainage conditions in some locations are improved (due to the sandy soil being more pervious). The Airport is also located in a seismically active region, which can compound the effects of poor geology and soils. Although most of potential development areas have geology and/or soils constraints, these can usually be overcome with appropriate engineering treatments, such piles or surcharging the development site to accelerate settlement, as required.

Generally, undeveloped areas present a constraint due to geology and soils, as described above. However, it is anticipated that these constraints could likely be overcome with appropriate engineering solutions. Already developed areas being considered for additional development do not present any benefits or constraints because appropriate engineering solutions are known and available to solve any potential geology and soils issues (as demonstrated by the existing development). Also, geotechnical data is generally available in the developed areas, as opposed to the more undeveloped areas. For the potential parking development areas, it is anticipated that poor geology and soils will be less critical to the development of surface parking lots (as opposed to parking structures), except Area 6, which is anticipated to have geology and soil challenges because of a large drainage basin in this area (significant fill would be required and settlement could be an issue). However, appropriate engineering solutions could likely overcome these challenges, but might be cost-prohibitive.

Hazards and Hazardous Materials
The most likely hazard or hazardous material encountered at the Airport is contaminated soils (e.g., hydrocarbons from aircraft operations and maintenance found in the soil). As with geology and soils, appropriate clean-up and engineering solutions can usually overcome any potential hazard or hazardous materials constraint. In general, currently or previously developed sites might have a constraint due to hazards and hazardous materials, while largely undeveloped sites, such as the central basin might have fewer hazards or hazardous materials constraints (because aircraft have never been operated or maintained there). However, even these could contain some contaminants due to runoff from adjacent developed areas. Localized hazards or hazardous materials could always be a challenge and must be cleaned up or engineered during the appropriate phase of project development.

In the case of potential general aviation development Area 3, this would normally be shown with no potential constraint, except that this area has historically been used for aircraft runs. Therefore, this area is marked with an unknown benefit or constraint from a hazards and hazardous materials perspective. Also, any areas adjacent to the existing fuel farms might contain contaminated soil.

Hydrology and Water Quality
For the purposes this environmental screening, it was assumed that any newly created impervious surfaces (e.g., pavement in a parking lot or aircraft apron, buildings, etc.) might create a potential environmental constraint. Pervious surfaces allow rainwater to percolate into the soil and/or traverse the surface through dirt, grass, and other vegetation, improving water quality. As with geology / soils and hazards / hazardous materials, hydrology and water quality constraints created by new impervious surfaces can be addressed through appropriate environmental engineering solutions, such as the construction of bio-swales and detention basins. In the case of potential airline support facility development Areas 6 and 7, the potential hydrology and/or water quality constraints are unknown because any potential benefit or constraint depends on the exact location of any development within the area.

Land Use and Planning
There are no potential land-use benefits or constraints associated with any of the development areas, with the possible exception of terminal development Area 3, which might be partially located within the City of San Leandro.

Public Access
There are no potential public access benefits or constraints associated with any of the development areas. As with the other site planning considerations, this preliminary assessment could change as projects in these areas are more fully developed and undergo detailed environmental review, engineering, etc.

Utilities and Service Systems
There are no potential utilities and service systems benefits or constraints associated with any of the development areas. As with the other site planning considerations, this preliminary assessment could change as projects in these areas are more fully developed and undergo detailed environmental review, engineering, etc.

6.5.2 Operational Planning Considerations

This section summarizes the operational planning considerations for the master plan forecasts developed in Chapter 3. As shown on Table 6.2, airline passengers and passenger airline operations, air cargo weight and cargo airline operations, and general aviation operations are all anticipated to increase (at varying rates described in Chapter 3). This increase in aviation activity is evaluated against the following five operational planning criteria:

Aircraft Noise — CNEL
Although CNEL noise contours are developed assuming all aircraft operations (airline, cargo, and general aviation), the evaluations here attempt to show how each type of operation contributes to the overall CNEL contours. As described in Section 6.3.9, the overall CNEL noise contours in 2010 (assuming the master plan aircraft operations forecasts) are smaller (less noise footprint)
than the existing (2004) noise contours. In general, the modest increase in the number of passenger airline and general aviation operations do slightly increase the CNEL noise contours. However, anticipated changes in the air cargo fleet have a significant effect in reducing the CNEL contours in the future (2010 timeframe). That is, when the cargo airlines retire their older and noisier Boeing 727 aircraft and replace them with larger (to accommodate the increase in air cargo weight), quieter aircraft, the CNEL contours are anticipated to get smaller (less noise footprint).

**Aircraft Noise — SEL / SENEL**
Generally, this evaluation criteria represents a potential constraint as the number of operations increases because there will be more noise events (one with each operation, which is anticipated to increase as shown on Table 6.2). However, in the case of the cargo airlines, the increase in the number of operations is small (in fact, there are no anticipated new cargo airline flights at South Field in 2010 compared to 2004) and the cargo aircraft in 2010 are anticipated to be quieter than the existing air cargo fleet, as described above.

**Air Quality**
The increase in aircraft operations has an unknown benefit or constraint on air quality, and additional environmental review would be required to determine the relationship between the increase in the number of operations and air quality. Also, assumptions would need to be made regarding future facilities, such as the airfield improvements shown in Figure 5.2 and 5.3, because they could provide air quality benefits, which might offset any constraint associated with the anticipated increase in operations.

**Transportation / Traffic**
It is anticipated that the increase in the number of airline passengers and air cargo weight would generate additional traffic and transportation requirements to and from the Airport. As with other planning considerations, it is anticipated most constraints could be overcome with appropriate traffic and transportation engineering solutions. Additional study would be required to determine how increases in traffic associated with increased aviation activity would affect the surrounding communities. For example, it is not known how much of the traffic accessing OAK uses local streets in the cities of Alameda and San Leandro. General aviation is not a significant generator of traffic and transportation demand, and thus it is assumed that it has no potential environmental benefit or constraint, even with the anticipated increase in activity.

**Safety**
There are no potential safety benefits or constraints associated with the anticipated increase in aircraft operations at OAK.

### 6.5.3 Environmental Constraints / Benefits of Recommended Development Areas

For each development area discussed in Chapters 4 and 5, the preliminary environmental screening matrix (Table 6.2) highlights potential environmental benefits or constraints (vertically, in each column under the development area). For example, potential terminal development in Area 2 is not anticipated to have any major environmental constraints, with the exception of hazards and hazardous materials, such as contaminated soils, that might need to be cleaned up or engineered, as appropriate, before development occurs (or as otherwise required by regulatory agencies).

### 6.6 Community-Requested Environmental Projects

Port staff asked members of the Stakeholder Advisory Committee to consider any environmentally beneficial projects that they may wish request be included in the master plan (in addition to all of the environmental programs and policies the Port already has underway). The City of San Leandro representatives requested that the Port consider constructing a noise barrier to block aircraft ground noise in the Neptune Drive neighborhood. The City of Alameda representatives requested that Port and City of Alameda jointly undertake a ground traffic study to determine how much traffic going to or from the Airport uses local streets in the City of Alameda. The City of San Leandro representatives requested that the study be expanded to include local streets in the City of San Leandro. It is recommended that the Port undertake an Airport traffic study, with assistance from the cities of Alameda, San Leandro, and Oakland. Finally, the City of Alameda representatives requested that the Port and City of Alameda jointly conduct a study to investigate why some corporate jets (less than 2%) choose not to comply with the Port’s voluntary noise abatement procedures, which requests that they taxi to and depart from South Field instead of North Field (during west plan, except those that can depart on Runway 33). It is recommended that the Port undertake this study, with assistance from the City of Alameda.

The following sections summarize the Port’s investigation into a San Leandro noise barrier.

#### 6.6.1 Noise Barrier Background

The noise from jet aircraft operating on Runway 29 has been a concern to residents living along Neptune Drive in the City of San Leandro. In particular, the issue of jet back blast noise at the beginning of takeoff roll has been raised as an issue that might be addressed by some kind of noise barrier located adjacent to the runway. In the following sections the feasibility of such a barrier located near the runway or near the residences is examined.
6.6.2 The Noise Barrier Effect

A noise barrier is effective at reducing noise when the barrier is located between the noise source and the receiver and is high enough to block the direct line of sight between the source and the receiver. The barrier must be long enough to prevent flanking around the sides of the barrier, have no holes or cracks, and have sufficient density so that sound does not pass through the barrier. Barriers are most effective when placed very near the source or the receiver and is least effective when placed half way between the source and the receiver. Figure 6.19 shows schematically the direct line of sight and the path over the top of a barrier for a barrier located near the source and for a barrier located near the receiver.

Noise barriers are commonly used to mitigate roadway noise, particularly adjacent to freeways. Barriers are not typically used for airport noise with the exception of barriers around locations where aircraft engine maintenance runups are performed (such as the ground runup enclosure, GRE, located on the South Field at OAK). It is rare to use a barrier to mitigate pre-takeoff engine runup noise.

Noise barriers are very good at mitigating high frequency noise and very poor at mitigating low frequency noise. The amount of noise reduction that a barrier will achieve is dependent on the height of the barrier and frequency of the noise. A noise barrier will not effectively reduce the low frequency rumble associated with some of the louder, older technology jets that operate at Oakland, such as the Boeing 727. A noise barrier has no effect unless the barrier is high enough to block line of sight between the source and the receiver. For a typical noise source such a diesel truck or an aircraft without major low frequency rumble, a noise barrier that is just high enough to break line of sight will result in a 5 dBA noise reduction, provided that the barrier is long enough to prevent flanking around the ends (i.e., sound leaks around the ends). The higher the barrier, the greater the noise reduction (there is a practical limit of about 20 dBA noise reduction for very tall barriers).

A noise barrier to reduce high frequency taxi and Runway 29 take-off roll noise in the Neptune Drive neighborhood could be constructed either on-Airport (near the end of Runway 29 along San Francisco Bay) or in the rear yards of the homes along the west side of Neptune Drive (along San Francisco Bay). It is important to note that only the homes along the west side of Neptune Drive would benefit from a potential noise barrier, whether constructed on-Airport or along the rear yards of the homes along the west side of Neptune Drive. This limited benefit is because the homes along the west side of Neptune Drive already serve as a noise barrier and block much of the high-frequency taxi and Runway 29 take-off roll noise from the rest of the neighborhood.

6.6.3 Barrier Near the End of Runway 29

The potential to locate a noise barrier near the end of Runway 29 is severely constrained by the mandatory Object Free Area associated with a runway of this type. The Object Free Area is designed to minimize aircraft damage and loss of life in the event of an aircraft excursion from the runway. Object Free Areas have fixed dimensions and are mandated by the FAA. Figure 6.20 shows the potential location of the noise barrier at the departure end of Runway 29. The Object Free Area sets a southern limit to the barrier (shown in yellow). This barrier would just barely block line of sight for an aircraft located at the start of Runway 29 relative to the homes on Neptune Drive. The barrier would need to extend farther south (into San Francisco Bay) to prevent sound flanking around the southern end of the barrier. In order to examine the potential effectiveness of such a noise barrier, a detailed analysis of the effectiveness of a barrier was completed for aircraft in various positions as shown in Figure 6.20.

Aircraft in positions A, B, C, D and E were considered in the analysis. Aircraft at positions A and B would be taxiing and therefore at a low engine thrust level. For position C an aircraft may be stopped at the hold position and use a higher thrust level to get the aircraft moving (break-away thrust). Aircraft at positions D and E would be at a very high thrust setting for takeoff.

In order to examine the effect of a barrier near the end of Runway 29 an example case was calculated for a Boeing 727 Hushkit aircraft. This is one of the types of aircraft that FedEx uses at night and of which the community has expressed concern. This aircraft has 3 engines, one of which is a centerline engine that is located 15 feet above the pavement (to engine centerline). This analysis was done for an observer located in the rear yard of the southern most home on the Bay side of Neptune Drive.

The barrier assumed for this analysis was a 25 foot high barrier located on top of the dike (levee) that separates the Airport from San Francisco Bay. This dike has a top elevation of about 10.5 feet, thus the top of barrier elevation assumed for this analysis was about 35.5 feet above mean sea level (MSL). The runway and taxiway elevation used was 5.5 feet MSL. The elevation of the rear yard of the home on Neptune Drive is about 6 feet MSL.

The noise barrier reduction was calculated for a case of no wind and no vertical temperature gradient, in other words a very calm condition where the ambient noise levels along Neptune Drive would be very low. The noise barrier noise reduction is about 6 dBA (the actual calculation vary from 5.6 to 6.3 dBA for the 5 aircraft positions shown in Figure 6.20) except when the aircraft is located at the runway threshold (position D). At position D there will be flanking around the south end of the barrier, and the barrier noise reduction will be closer to 3 dBA instead of 6 dBA, unless the barrier could be extended into San
Francisco Bay, as shown in Figure 6.20, in which case a 6 dBA noise reduction would be possible. Extending the barrier into San Francisco Bay prevents the flanking of noise around the end of the barrier at the start of the take-off roll. It should also be noted that the noise levels at the observer on Neptune Drive are heavily influenced by the thrust setting on the engines. The table on Figure 6.20 summarizes the maximum noise level and effectiveness of the noise barrier.

A 6 dBA noise reduction is noticeable but not dramatic. A 10 dBA reduction would sound half as loud. A 3 dBA reduction would be barely perceptible. These results show that a barrier is of marginal value and may not be worth pursuing. At these levels of noise reduction, one would not expect residents to express great relief from existing noise levels as a result of installing this barrier. If this barrier is pursued it is important to emphasize to neighbors the limited benefit of the barrier and be careful not to raise expectations. Further, if the barrier is pursued, it need not extend as far north as is shown in Figure 6.20.

### 6.6.4 Barrier Adjacent to the Homes on Neptune Drive

An alternative to building the barrier near the runway is to build the barrier along the rear yards of homes on Neptune Drive. Figure 6.20 shows an aerial photograph of this alternative. Of course, one of the main disadvantages of such a barrier is that a tall barrier would block views of San Francisco Bay, a highly undesirable side effect of a barrier. This barrier would be effective only for first row of homes on the Bay.

An alternative to a solid opaque barrier such as that used adjacent to the Interstate Highway 880 in San Leandro is to use a transparent barrier. To be effective for the 2-story homes that are located along Neptune Drive, the barrier would have to be at least 15 feet high to get the minimum 5 dBA noise reduction for a second story observer. A 15-foot barrier would provide 12 dBA noise reduction for an observer in the rear yard of these homes, as shown in the table on Figure 6.20. In this concept, the barrier would consist of a low 4-foot solid wall, probably cement block, with 11 feet of transparent panel located above. The 11-foot panel would be installed in two 5½-foot sections in either a metal or wood frame. Block or cement pilasters would have to be spaced such that the wall would meet seismic and wind loading requirements. The footings for the pilasters for such a tall wall would have to be engineered for the type of soil, water content, and design wind loads for the area.

A transparent barrier will have a much greater maintenance requirement than an opaque barrier in order to keep the barrier clear and maintain views of the Bay. The moist salt air will be the biggest problem keeping the barrier clear. Glass would be easiest material to maintain, with maintenance being similar to cleaning the windows on a home. However, glass would be subject breakage either by vandals or objects blown into the glass by the wind. Plastic materials such as Plexiglass or Lexan are much more resistant to breakage, but will tend to pit, yellow, or fog with time. To maintain clear views, a plastic barrier will require occasional polishing and waxing. In either case, glass or plastic, the surface density of the material used shall be at 4 pounds per square foot to maintain the desired sound reduction (surface density is the density of the material divided by the thickness of the material).

Finally, the construction of such a barrier either on Airport or in the rear yards of the homes along the west side of Neptune Drive would be subject to the approval and permitting from the San Francisco Bay Conservation and Development Commission (BCDC) because these locations are within their jurisdiction. A barrier extending into San Francisco Bay would also require bay fill.

#### 6.6.5 Comparing a Barrier at the Airport with a Barrier near the Shore of Neptune Drive

The top of Figure 6.21 shows a comparison of noise levels when a Boeing 727 departs on Runway 29, beginning at the time the aircraft reaches the runway threshold (Position D on Figure 6.20). The top graph (blue line) shows the noise level in the rear yards of the homes on Neptune Drive as the aircraft progresses down the runway and there is no barrier. The next graph down (red line) shows the noise level at Neptune Drive if a 25-foot barrier is constructed at the Airport on top of the perimeter levee (outside of the Object Free Area). The lower graph (green line) shows the noise level in the rear yard of the Neptune Drive homes if a 15-foot barrier is constructed along the rear of these homes (along the Bay).

For an on-Airport barrier, there is only a 3 dBA noise reduction for the first 10 seconds of the event (assuming no extension of the barrier into San Francisco Bay), then the noise reduction increases as the aircraft proceeds down the runway and the barrier flanking is reduced. By about 18 seconds into the event, a 6 dBA noise reduction is realized. As the aircraft proceeds farther down the runway, the barrier effectiveness is reduced to about 5 dBA, and finally has no effect when the aircraft rotates and climbs. If the barrier could be extended into San Francisco Bay, there would be a 6 dBA noise reduction until the barrier effectiveness is reduced to about 5 dBA, and finally has no effect when the aircraft rotates and climbs. When the aircraft rises above the noise barrier, the noise increase will be sudden. However, since the noise barrier reduction at this point is about 5 dBA, the increase would not be considered dramatic. The bottom graph (green line) shows that a barrier along Neptune Drive provides a constant 12 dBA noise reduction until the aircraft rotates and climbs high enough to be seen above the barrier. When the aircraft rises above the noise barrier, the noise increase will be sudden and very noticeable.
Similar data are shown in the middle and bottom of Figure 6.21 for the Boeing / McDonnell Douglas MD-11 / DC-10 aircraft types and the Boeing 737 (-600, -700, -800, and -900 models) and Airbus A319 / A320 families of aircraft respectively. The scales of the figures are identical, and it shows that the Boeing 727 is much louder than the MD-11 / DC-10 types of aircraft and the much more frequently operated Boeing 737 / Airbus A319 / A320 family of aircraft.

In the case of the MD-11 / DC-10 aircraft, there is no noise barrier reduction for an on-Airport barrier while the aircraft is at the end of the runway at the start of takeoff roll. This is because the tail-mounted third engine is located over 32 feet above the ground and is not shielded by the barrier until the aircraft rolls down the runway some distance.

In the case of the Boeing 737 / Airbus A319 / A320 families of aircraft, the noise reduction of an on-Airport barrier is greater than for the other aircraft because the engines are located much closer to the ground (under 5 feet from the surface to the engine centerline), making the barrier more effective at reducing noise. However, these aircraft are much quieter and probably only audible along Neptune Drive during the calmest and quietest times.

The noise level calculations for with and without barrier conditions were computed for an observer standing in the backyard of a home along the Bay side of Neptune Drive. The computations assume no wind whatsoever (less than 1 knot). Under these conditions, the aircraft application of power at the start of takeoff roll would be audible at the homes on Neptune Drive. For conditions where the wind is not calm, the presence of wind noise and noise caused by the wind (such as the water lapping on the rocks on the shore) would mask the aircraft noise, and affect the propagation sound in such a way that the noise barrier computations made here would not be realized. This is due either to wind noise masking the aircraft noise or wind gradients affecting the propagation of sound over a long distance. The potential benefit of a noise barrier is greatest when the wind is calm and diminishes rapidly as the wind speed increases.

As described earlier, it is important to note that only the homes along the west side of Neptune Drive would benefit from a potential noise barrier, whether constructed on-Airport or along the rear yards of the homes along the west side of Neptune Drive. This limited benefit is because the homes along the west side of Neptune Drive already serve as a noise barrier and block much of the high-frequency noise taxi and Runway 29 take-off roll noise from the rest of the neighborhood.

In January 2006, the City of San Leandro hosted a meeting with the Neptune Drive neighborhood so that the Port could present the above analyses on a potential noise barrier either on-Airport or along the rear yard of the homes on the west side of Neptune Drive. All homeowners along the west side of Neptune Drive that expressed an opinion indicated that they did not want a noise barrier constructed in their rear yards despite the potential noise reduction benefit (up to 12 dBA during certain conditions, as described in Section 6.6.4). Instead, they requested that the Port continue to study the costs and benefits of constructing on-Airport noise barriers. Further, the community requested that the City of San Leandro and Port continue to pursue sound insulation as one of the most effective methods of reducing the effects of aircraft noise.
Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only; it does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Sound and Noise — What We Hear

*Note*: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only; it does not propose any particular course of action. It might represent an idea or concept that was discarded, and must be interpreted in the context of the entire master plan document.
Sound and Noise — Frequency Weighting

**Typical Frequency Range for Community Noise**

**Legend**
- A Weighted
- C Weighted

**Frequency Weighting**

Sound and noise are measured in decibels (dB), which is a logarithmic scale for measuring intensity. However, the human ear is not equally sensitive to all frequencies. The A-weighted decibel scale (dBA) is used to approximate the sensitivity of the human ear to different frequencies, making it more relevant for evaluating the perceived loudness of noise.

**Weighted Decibel Scales**

- **A-weighted**: Discriminates against frequencies in a manner approximating the sensitivity of the human ear. In the A-weighted decibel scale, everyday sounds normally range from 30 dBA (very quiet) to 100 dBA (very loud). Most community noise analyses are based upon the A-weighted decibel scale.
- **C-weighted**: An alternate scale used in assessing hearing loss in comparison to Occupational Noise Exposure to noise and is more influenced by low-frequency noise than the A-weighted scale.

**Acronyms**
- **dB**: Decibels
- **Hz**: Hertz

---

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Effects of Weather on Sound

- **Decreasing Temperature**
- **Increasing Temperature**
- **Wind**
- **Overcast Sky**
- **Shielding Provided by Structures and Reflection of Sound by Water**

**Legend**
- Sound Source
- Sound Direction

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan envisioned many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action to mitigate noise (as some concepts that were discarded, and must be interpreted in the context of the entire master plan document).
Sound Exposure Level (SEL), Maximum Noise Level (Lmax) and Duration

- Maximum Noise Level (Lmax) 90 dBA
- SEL ~ 100 dBA
- 10 dB Below Lmax
- Ambient Noise

Acronyms:
- dB: Decibels
- dBA: A-Weighted Decibels
- Lmax: Maximum Noise Level
- SEL: Sound Exposure Level

Note: This graphic is a work-in-progress and was prepared by the Port as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded) and must be interpreted in the context of the entire master plan document.
Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible sites and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not present any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.

Legends:
- Hourly Leq's (No Penalty)
- 5 dB Evening Penalty
- 10 dB Nighttime Penalty

Acronyms:
- CNEL: Community Noise Equivalent Level
- dBA: Decibels
- Leq: Equivalent Noise Level

Noise Metrics:

**Figures 6.6**

- **Sound Level, dBA**
  - One Hour Time Period, minutes*
  - **Sound Level, dBA**
    - 1 Hour Leq

- **Hourly Leq, dBA**
  - One Day 24-Hour Time Period
  - **Hourly Leq, dBA**
    - CNEL Noise Level

* Time axis not drawn to scale. Aircraft Events are much shorter than shown here.

**Note:** This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible sites and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not present any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Single Event Noise to Cumulative Noise (CNEL)

\[ SEL + 10 \log (1 \times Ops_{day} + 3 \times Ops_{evening} + 10 \times Ops_{night}) - 49.4 = CNEL \]
Examples of Community Noise Equivalent Levels (CNEL)

Typical Outdoor Locations

- Apartment Next to Freeway
- 3/4 Mile From Touchdown at Major Airport
- Downtown With Some Construction Activity
- Urban High Density Apartment
- Urban Row Housing on Major Avenue
- Old Urban Residential Area
- Wooded Residential
- Agricultural Crop Land
- Rural Residential
- Wilderness Ambient

CNEL in dB

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning scenarios. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded) and must be interpreted in the context of the entire master plan document.
Annoyance and Community Noise Equivalent Level (CNEL)

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Sleep Interference

Indoor Sound Exposure Level (SEL) in dB

Percentage Awakening

Figure 6.10

Acronyms

dB  Decibel
FICAN  Federal Interagency Committee on Aircraft Noise
FICON  Federal Interagency Committee on Noise
SEL  Sound Exposure Level

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Summary of FAA Part 150 Noise and Land Use Guidelines for New Development

<table>
<thead>
<tr>
<th>Permitted Land Use</th>
<th>Yearly CNEL, dB</th>
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<tr>
<td>&lt; 65</td>
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</tr>
<tr>
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<td>70 - 75</td>
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<tr>
<td>75 - 80</td>
<td>No</td>
</tr>
<tr>
<td>80 - 85</td>
<td>No</td>
</tr>
<tr>
<td>&gt; 85</td>
<td>No</td>
</tr>
</tbody>
</table>

### Acronyms
- CNEL: Community Noise Equivalent Level
- FAA: Federal Aviation Administration

### Notes:
- This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
- This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Aircraft Noise Abatement Procedures for North Field Program

General Policy
Safety permitting, aircraft flying by visual flight rules are to avoid flying over nearby residential areas when arriving or departing the Airport.

Day and Night Aircraft Restrictions
The following aircraft shall not depart Runways 27L/R, nor land on Runways 9R/L, except during emergencies. These aircraft must use Runway 11/29:
• Turboprop aircraft over 17,000 pounds
• Four-engine reciprocating powered aircraft
• Surplus military aircraft over 12,500 pounds
• Regularly scheduled passenger and cargo airlines or regional jet aircraft requiring operations shall not land on Runways 27L/R at the North Field, except for emergencies or when Runway 11/29 is closed for maintenance or repair.

Helicopter Restrictions
• Helicopters should fly over freeways and water as much as possible to avoid hotels and residential areas.
• Local training flight patterns (touch-and-go operations, etc.) should be restricted to Airport boundaries or adjacent commercial and industrial areas to the maximum extent possible.

Daytime (6:00 a.m. to 10:00 p.m.) Aircraft Restrictions — Single and Twin Piston-engine Aircraft
VFR Departures
• Aircraft departing Runways 27L/R, turn over San Leandro Bay, continue to the 1880 freeway.
• Straight out departures should not be approved.
• Aircraft departing Runway 33 turn right and fly over San Leandro Bay, continue to the 1880 freeway.
• Straight out or left crosswind downwind departures should not be approved.

VFR Arrivals
• Aircraft should avoid flying over residential areas as much as possible on arrival to any North Field runway.
• Straight in arrivals to Runway 15 are not allowed unless required by wind or safety.

Touch-and-Go Operations
• Runway 27, is the preferred runway for these procedures.
• Aircraft should fly the standard traffic pattern by avoiding flying over residential areas.

Nighttime Quiet Hours (10:00 p.m. to 6:00 a.m.) Aircraft Departures
• Aircraft should use Runway 9R (not 9L) as the preferred departure runway.
• Aircraft should use Runway 27R (not 27L) as the preferred departure runway.
• Aircraft should not turn left from Runways 9R/L, on departure.
• Aircraft should not depart straight out from Runway 9L.
• All aircraft over 75,000 pounds are directed to use Runway 11/29.
• Aircraft should only use full-length departures on the elected runway.
• Stage 2 corporate turbojet aircraft are directed to use Runway 11/29.

Pilots may choose between the following noise abatement departure procedures, wind and weather permitting:
• VFR Departures use right crosswind or additional downwind segment avoiding Alameda residences.
• The SALAD Standard Instrument Departure Procedure allows pilots not to use the OAK 313 radial or 310 heading departure.

VFR and IFR Departures From Runway 9L/R
• For Runway 9R departures, use 180-180 degree departure headings.
• For Runway 9L/R departures, use right turn over the Airport for north/northeast departures.

Aircraft Arrivals
• Aircraft should use Runway 27L, as the preferred arrival runway.

Oakland International Airport Departure Routes

Aircraft Noise Abatement Procedures for South Field Program

Day and Night
Runway 11/29 is preferred for departures and arrivals of all turbojet and heavy aircraft.

Runway 29 Departures
• Turboprops shall not be turned north over Oakland Hills until leaving 3,000 feet.
• VFR aircraft that depart Runway 29 and request a right turn shall be instructed to proceed at least 2 miles west or climb to at least 1,500 feet before starting right turn.

Runway 29 Arrivals
• Air traffic controllers require turbojet aircraft on a visual or VFR approach northeast of OAK to cross the Oakland 100 radial at or above 3,000 feet.
• Between the hours of 10:00 p.m. to 6:00 a.m., and at other times when traffic permits, air traffic controllers keep turbojet aircraft over the Bay when approaching from the west, south, of OAK.

Nighttime (10:00 p.m. and 7:00 a.m.)

Runway 29 Silent 7 Departure Procedure
• Reduces noise on Alameda and other East Bay communities
• Turns turbojet aircraft to the west and further out over the Bay when departing from Runway 29

Runway 11 Quiet Departure Procedure
• Reduces noise on San Leandro and other East Bay communities
• Turns turbojet aircraft to the right and further out over the Bay when departing from Runway 11

Rolling Take-off Departure Procedure
• Used for takeoffs in which engine power is applied and the takeoff roll commenced immediately as an aircraft is taxied onto the runway
• Reduces “back blast” noise
• Applied to turbojet departures between 1:00 a.m. and 5:00 a.m.

Acronyms and Definitions
APM: Airport Development Program
ANOMS: Airport Noise and Operations Management System
CLASS: Citizens League for Airport Safety and Serenity
FRA: Federal Aviation Administration
GRE: Ground Run-up Enclosure
IFR: Instrument Flight Rules
LOR: Berkeley Keep It and Over the Bay Committee
MST: Maximum Takeoff Weights
NOM: Noise Abatement Measures
SP: Sound Insulation Program
USPS: United States Postal Service
VFR: Visual Flight Rules

Sources
Mestre Greve Associates
Oakland International Airport Development
Port of Oakland

Notes:
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Community Outreach and Public Participation

Oakland Airport Community Noise Management Forum

Public participation is encouraged at the Oakland Airport Community Noise Management Forum, which meets quarterly to address community noise concerns.

North Field Research Group

A technical sub-committee of the Forum, the North Field Research Group meets quarterly with community representatives, the FAA and Airport users.

South Field Research Group

Another technical sub-committee of the Forum, the South Field Research Group meets quarterly with community representatives, the FAA and Airport users.

Board of Port Commissioners Aviation Committee

The Aviation Committee of the Board of Port Commissioners holds meetings with representatives from the City of Alameda, CLASS and KJOB, and the San Leandro City Council Airport Committee three times per year for each group.

Pilot Brochure — Noise Abatement Procedures for North Field

Designed for pilots, this brochure includes a diagram of the Airport and an aerial photograph of the community.

Noise Management Brochure

This brochure describes the overall noise management program at Oakland International Airport.

Noise Management Program Website

Located at www.flyoakland.com, this website provides:

- Basic information on Airport and aircraft noise programs
- Preferred daytime and nighttime aircraft flight procedures
- All routine noise abatement reports
- A flight replay system
- Educational materials such as ad-hoc reports, an airport noise glossary, Forum meeting information, and links to important and relevant websites

Oakland International Noise Abatement Procedures

Noise Reduction Programs, Studies and Other Commitments

City of Alameda — Residential

Sound Insulation Program

To date, approximately 500 homes have been insulated on Bay Farm Island. The final one will be completed in 2006.

City of San Leandro — Residential

Sound Insulation Program

The Port will fund insulation expenses for 200 homes in San Leandro that are located south of I-880, and will also fund up to $100,000 for city administration costs.

City of San Leandro — School

Sound Insulation Program

The Port will fund insulation expenses for the following schools in the San Leandro Unified School District. Each school will receive $1,200,000 to cover insulation expenses: Murt, Wilson, Monne, Garfield and Corvallis Schools.

San Leandro Sound Studies

The Port conducted sound studies of the Mulford Gardens Branch Library and eight schools in San Leandro. The studies showed that existing conditions were sufficient to meet state law standards and that additional sound insulation was not required for the library and three schools identified in the Settlement Agreement.

Crosswind Runway Alignment Study

The Port, City of Alameda, and CLASS jointly undertook a noise study of single event and low frequency noise impacts associated with the cross wind runway alignments previously proposed by CLASS. The results showed that benefits were offset by noise increases in other communities east and south of the Airport.

Airport Tenant Orientation Program

The Port agreed to provide its existing and future tenants with information about the Airport’s noise abatement practices and to gain their commitment to follow the procedures. Statements are attached to lease agreements.

General Aviation VFR Aircraft Study

The Port, City of Alameda, and CLASS agreed to jointly undertake an evaluation of general aviation aircraft departures from Runways 27L/R and 33 under visual flight rules. This project was completed in 2002.

Preferential Runway Use Agreement for San Leandro

Representatives from the City of San Leandro and the Port will work together to prepare and coordinate with FAA a preferential runway use agreement for North Field that addresses the mutual noise mitigation concerns relative to North Field nighttime operations and touch-and-go operations.

Ongoing Noise Abatement Work with the FAA

The Port agreed to continue to work with the FAA to gain their cooperation in implementing the Airport’s noise abatement programs on the behalf of the City of Alameda, CLASS, and KJOB.

Master Plan

The Port agreed to prepare a 20-year Master Plan for the Airport in accordance with FAA Advisory Circular 150/5070-6A. Members of the Master Plan Stakeholder Committee include representatives from the cities of Alameda, San Leandro and Oakland, CLASS, and the San Leandro Unified School District. KJOB also was invited to participate.

Runway 11/29 Length Agreement

The Port agreed not to propose, approve, or construct any extension of Runway 11/29 that would give Runway 11/29 a total effective length in excess of 11,600 feet.

Meet and Confer Agreement

The petitioners agree to meet and confer in good faith with Port on any future efforts by Port to secure amendments for and construct an outboard runway at the Airport.

USPS Facilities Agreement

The Port agreed not to construct or enter into new leases that authorize construction of or modifications to the USPS facilities identified in the ADP as Project D.2 at any location on the Airport for at least 20 years.

Additional Noise Monitors Agreement

The Port agreed to install, operate, and maintain two remote monitoring terminals at the locations identified by KJOB when KJOB provides Port with written notice of the location for the noise monitoring sites and submits easements for the sites.

No New Runway Construction on North Field

The Port agreed not to construct any new runways on any portion of the North Field.

No Runway Expansion on North Field

The Port agreed that existing North Field runways may not be realigned or lengthened, or widened, etc., if the purpose of doing so is to increase the runway weight and load capacities to accommodate operations beyond alternate use by air carriers.

Sources

- City of Alameda, CA
- City of San Leandro, CA
- CLASS
- KJOB
- NAPA
- RIAA
- US Department of Transportation
- US Government
- FAA
- UPS
- County of Alameda
- County of Oakland

Acronyms and Definitions

AIRP Airport Noise and Operations Management System

CLASS Citizens League for Airport Safety and Serenity

FAA Federal Aviation Administration

KJOB Berkeley Keep Jets

OEI Over the Bay Committee

VALAD An Association of five airports

HD Standard Instrument Departure

SIP Sound Insulation Program

USPS United States Postal Service

VFR Visual Flight Rules

Notes

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### Acronyms

- **dB**: Decibels
- **SEL**: Sound Exposure Level, also known as SENEL

### Time Periods

- **Day**: 7 am – 7 pm
- **Evening**: 7 pm – 10 pm
- **Night**: 10 pm – 7 am

### Boeing 737 & A319/320 Departure

<table>
<thead>
<tr>
<th>Year</th>
<th>Day 60 dB SEL</th>
<th>Evening 65 dB SEL</th>
<th>Night 90 dB SEL</th>
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<td>116</td>
<td>37</td>
<td>22</td>
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<tr>
<td>2010</td>
<td>185</td>
<td>32</td>
<td>33</td>
</tr>
</tbody>
</table>

**Note**: These aircraft do not have identical noise contour footprints, but are very similar and are grouped here for display purposes.

**Time Periods**: Most night operations of B737 aircraft occur between the hours of 10pm and 11pm and between 6am and 7am.
**LEGEND**

80 dB SEL

85 dB SEL

90 dB SEL

**Time Periods**

Day: 7 am – 7 pm

Evening: 7 pm – 10 pm

Night: 10 pm – 7 am

**Acronyms**

dB: Decibels

SEL: Sound Exposure Level, also known as SENEL

---

**Figure 6.14**

Night Single Event Noise Contours

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**Note:** This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not represent any particular course of action or idea or concept that was discarded, and must be interpreted in the context of the entire master plan document.
Figure 6.15
Community Noise Equivalent Level (CNEL) Contours 2004

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Figure 6.16
Community Noise Equivalent Level (CNEL) Contours 2010

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Acronyms

CNEL: Community Noise Equivalent Level

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Air Quality Programs

Alternative Fuel Programs
- Ground transportation providers are required to have 50% of their fleet in alternative fuel vehicles (taxis, door-to-door shuttles, off-airport parking shuttles, hotel shuttles, etc.).
- Airport light duty fleet, where practical, is alternative fuel vehicles.
- Airport heavy-duty fleet uses ultra low sulfur diesel.

Airport Compressed Natural Gas (CNG) Fueling Facility
- Facility opened in July 2002.
- Open 24 hours.
- Serves Port vehicles, private operators and general public.

CNG Refueling Station Fueling Volumes, 2002–2005

Air Craft Ground Power and Pre-Conditioned Air Loading Bridges
- Newly constructed loading bridges provide pre-conditioned air and reduce air emissions. Without pre-conditioned air and ground power, aircraft generate electricity by running on the aircraft’s jet fuel.

Trip Reduction Program
- Airport coordinates and provides shuttle schedule information to Airport tenants.
- Discount AirBART tickets are available to employees.
- Vanpool parking is available.
- Employee commute survey was completed in April 2004. 87% of respondents indicated they drive to work alone but would consider alternative transportation, if given incentives. Airports is analyzing data and will develop a trip reduction program including travel demand recommendations, communication materials for use by tenants and provide on-going commute program support.

Ground Service Equipment (GSE) Alternative Fuel Program
- GSE includes: conveyor belt luggage loaders, forklifts, food service vehicles, bags, baggage carts, etc.
- GSE typically runs on either diesel or gasoline.
- Airport staff is working with airlines on local and national level to address ways to replace GSE fleet with alternative fuels.
- Airport staff is currently conducting an inventory of equipment and exploring grant opportunities to help offset costs.

BART-OAK Connector (BART Connector)
- Airport supports development of BART Connector.
- For the last 12 months ending April 30, 2005, AirBART carried over 1,154,000 riders.
- Employees receive discount tickets for riding AirBART, resulting in 3% of the ridership.

Wetlands Management Program
Oro Loma
- The program restored a 16-acre diked and filled area of former bylands on Oro Loma Sanitary District land. Restoration was completed in September 2000 and monitoring of the project continues through 2005.

Damon Slough
- The program expanded and expanded a 9-acre seasonal wetland adjacent to Martin Luther King Jr. Regional Shoreline.

Burrowing Owl Mitigation Program
- Burrowing Owls are a California “Species of Concern.” To provide long-term maintenance of a stable Burrowing Owl population, construction impacts on their habitat are mitigated on an ongoing basis. Accordingly, the Port purchased 70 acres in eastern Alameda County to establish off-Airport mitigation.
- Ownership of 70 acres was transferred to California Department of Fish and Game.

Recycling Programs

Recycling in the Passenger Terminals
- Port launched first passenger recycling program on Earth Day 2002.
- The program has since expanded to collect newspapers, magazines, office paper, cans and bottles.
- In 2004, the program diverted over 298 tons of material from the landfill.

Food Waste Program
- Food waste recovery was added in 2004.
- Program collects pre-consumer waste such as vegetable trimmings, coffee grounds and filters, milk cartons, cheesy pizza boxes and used paper towels from Airport food concessionaires.
- Material is then used as a high nutrient fertilizer in the production of organic food.
- 51 tons were diverted from the landfill in 2004.

Airline Consolidated Waste and Recycling Program
- Prior to 2003, each airline contracted separately with a waste company and little recycling was achieved.
- Airport worked with airlines to consolidate both their waste and recycling into one coordinated program.
- Airlines recycle magazines, newspapers, cardboard and bottles.
- In 2004, the airlines diverted over 101 tons of material from the landfill.

Airport Materials Management Program
- The Port has implemented a program to manage materials from ongoing construction, demolition and maintenance projects at the Airport.
- Purpose: recycle and reuse processed construction materials on future projects.

Recycling Volume, 2003–2004

Figure 6.18

Water Quality Program

Stormwater Programs
- Port has a monitoring program to raise awareness of water quality issues and assist in compliance with State Water Resources Control Board’s industrial permit.
- Port holds workshops, training, collects and analyzes stormwater samples, and inspects facilities.
- Port provides assistance to contractors on developing storm water pollution prevention plans.

Environmental Programs Information on Website
- The Airport website is currently being updated to provide basic information on the Airport environmental programs.

Terminal Two Extension — LEED Certification
- Terminal 2 extension has been designed using green building criteria known as LEED, or Leadership in Energy and Environmental Design. LEED provides a complete framework for assessing building performance, emphasizing water savings, energy efficiency, material selection and indoor environmental quality.

Public Access
- A grade-separated pedestrian/bike trail has been completed along southeast side of Airport Drive. The Airport is working with San Leandro to bridge this trail with the Bay Trail along the Metropolitan Golf Links and is facilitating the construction of a trail bridge over San Leandro Slough to connect the Bay Trail that runs all the way to Hayward. An on-road and grade-separated bike trail was constructed on Ron Cowan Parkway, providing connection between the Airport and Alameda.

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and the planning programs only do not represent any particular owner of active (137) or concept that was discarded, and must be interpreted in the context of the entire master plan document.
Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not represent any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.

Note: Graphics are not to scale.

LE G E N D

Sound Source
Sound Direction
Line of Sight Between Source and Receiver

Potential Takeoff Noise Barrier Near Source or Receiver

Barrier Near Source

Barrier Near Receiver
Potential Takeoff Noise Barriers

- Aircraft are not to scale.
- Noise estimates are for a very calm wind.
- Noise barrier calculations include only one barrier, either at the airport or at Neptune Dr.
- Noise barriers will have little effect on low frequency noise.

### Lmax, dBA at Neptune Drive Backyard

<table>
<thead>
<tr>
<th>Aircraft Position &amp; Thrust</th>
<th>Without Barrier</th>
<th>Noise Reduction</th>
<th>Noise with Barrier</th>
<th>Noise Reduction</th>
<th>Noise with Barrier</th>
<th>Noise Reduction</th>
<th>Noise with Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 100%</td>
<td>73</td>
<td>3</td>
<td>70</td>
<td>6</td>
<td>67</td>
<td>12</td>
<td>61</td>
</tr>
<tr>
<td>A 100%</td>
<td>73</td>
<td>6</td>
<td>67</td>
<td>6</td>
<td>67</td>
<td>12</td>
<td>61</td>
</tr>
<tr>
<td>B 100%</td>
<td>73</td>
<td>6</td>
<td>67</td>
<td>6</td>
<td>67</td>
<td>12</td>
<td>61</td>
</tr>
<tr>
<td>C 100%</td>
<td>73</td>
<td>6</td>
<td>67</td>
<td>6</td>
<td>67</td>
<td>12</td>
<td>61</td>
</tr>
</tbody>
</table>

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action. It might represent an idea or concept that was discarded, and must be interpreted in the context of the entire master plan document.
Potential Effect of Barrier on Departure Noise
No Wind, Outdoor Noise Level, Neptune Drive Backyard

<table>
<thead>
<tr>
<th>Time Periods</th>
<th>Average Daily Departures</th>
<th>Boeing 727</th>
<th>Boeing MD-11/DC-10</th>
<th>Boeing 737–700</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 2004</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day</td>
<td>3</td>
<td>3</td>
<td>116</td>
<td>116</td>
</tr>
<tr>
<td>Evening</td>
<td>1</td>
<td>1</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>Night</td>
<td>4</td>
<td>4</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Year 2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day</td>
<td>1</td>
<td>1</td>
<td>185</td>
<td>185</td>
</tr>
<tr>
<td>Evening</td>
<td>0</td>
<td>0</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Night</td>
<td>2</td>
<td>2</td>
<td>33</td>
<td>33</td>
</tr>
</tbody>
</table>

* Includes all B737 and A318, A319, and A320 models
** Most night operations of B737 aircraft occur between the hours of 4pm and 7pm between June and Jan

Note: This graph was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graph is conceptual in nature and the planning process only strives not to propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Chapter 7: **Financial Considerations**

“Customers demand low fares. Low cost, efficient airports are vital in meeting that demand.”

— Gary C. Kelly, Vice Chairman of the Board and Chief Executive Officer, Southwest Airlines Company

### 7.1 Introduction

This chapter provides an overview of airport finances and then presents a financial plan for the potential near-term master plan projects (see Chapter 8). The financial plan is a screening-level analysis to determine if the potential master plan projects should even continue to be explored from a financial perspective. That is, if the potential master plan projects (either collectively or individually) appear to be well beyond the range of potential affordability, then they need not be considered for inclusion in the master plan.

It is important to note that this chapter is intended to provide a general overview of airport finances as they relate to the Port of Oakland and Oakland International Airport. It is not intended to give a comprehensive assessment of the Port or Airport for purposes of making investment or other decisions. The information contained in this chapter (like information contained in the other chapters) will change over time, and no obligation to update or revise it is created. Any potential investor in the Port’s long-term or short-term debt should review appropriate disclosure documents provided by the Port in connection with such debt, and should not rely on the master plan or this chapter in making investment decisions.

FAA AC No. 150/5070-6A, Chapter 10 (Plan Implementation), Section 3 (Financial Plan), discusses various funding mechanisms for airport development projects and the need for a financial feasibility and economic analysis. This chapter of the master plan is based on the planning principles and guidance contained in FAA AC No. 150/5070-6A.

### 7.2 Overview of Airport Finances

The purpose of this section is to provide a brief overview of finances at Oakland International Airport (OAK). It summarizes Airport Ownership, Airline Agreement, Operating Budget, and the Capital Improvement Program as of June 2005.

#### 7.2.1 Airport Ownership

The Port of Oakland is an “independent department” of the City of Oakland established under the City’s Charter. The Port of Oakland is the City of Oakland, a municipal corporation, acting by and through its Board of Port Commissioners. The exclusive control and management of the Port is vested in the Board of Port Commissioners. Per the Charter, Commissioners are nominated by the Mayor and appointed by the City Council. The Port of Oakland owns and operates Oakland International Airport (OAK). Port staff responsible for managing and operating the Airport are part of the Port’s Aviation Division, which is one of three Port revenue divisions (the other two are Maritime and Commercial Real Estate). The Port’s Aviation Division is supported by several other divisions including Engineering, Social Responsibility, Finance, Communications, and the Port Attorney’s Office.

#### 7.2.2 Airline Agreement

Each airline serving OAK operates under a 10-year Airline Operating Agreement that is cancelable by either party (the airline or Port) on 30 days written notice. This cancellation policy is somewhat unusual in the aviation industry, but becoming more common. Many airports have long-term lease agreements with the airlines (sometimes as long as 20 or 30 years) for use of specific airport facilities, such as a terminal building or specific gates and holdrooms in a terminal building. Often, these long-term lease agreements give the airlines considerable control over the airport’s operating budget and capital improvement program (called Majority-In-Interest clauses). This is not the case at OAK, and the Port retains considerable control over the Airport’s facilities. Under the Agreement, the airlines must pay various rates and charges established by the Board of Port Commissioners by Ordinance (Port Ordinance No. 3634, as amended) for their use of Airport facilities, including the airfield and passenger terminals.

Airlines with a minimum number of daily flights are assigned one or more preferential (but not exclusive use) gates. The Port reserves the right to assign another airline to any gate as long as the preferential airline is not using it. The Port can also keep some gates unassigned for use directed by the Port. Terminal 1 ticket counters and gates are equipped with Common Use Terminal Equipment (CUTE), which allows any airline to log into their host computer system at any ticket counter or gate.

#### 7.2.3 Operating Budget

Like most local government agencies, the Port of Oakland and its Aviation Division have an operating budget and capital improvement program. Operating revenues and expenses are collected in seven cost centers.

**Cost Centers**

- Terminals
- International Arrivals Building (IAB)
- Contract Fueling
- Airfield and Ramp
- Ground Access and Parking
- Leased Area / Cargo / Oakland Maintenance Center (OMC)
- North Field (including a number of its own cost centers: Aircraft Operations and Parking Area, Leased Aircraft Hangars, T-Hangars, and Leased Area without Ramp)

These cost centers are either residual or compensatory.

**Residual Cost Centers**

In a residual cost center, the airlines are charged for the Port’s net operating (and capital) costs after allowing for any non-airline revenue attributable to the cost center. The following cost centers at OAK are residual: Terminals, Contract Fueling, and Airfield and Ramp.
For example, the Port incurs costs associated with operating and maintaining the terminal buildings. The Port must pay janitors to clean the concourses, building engineers to change light bulbs and repair jet bridges, and police to provide security. These labor and materials costs are collected in the Terminal cost center. The Port also generates revenue from concessions located in the terminals (typically as a percentage of individual concessionaire’s gross revenues). The airlines reimburse the Port for the operating costs collected in the Terminal cost center less concessions or other non-airline terminal revenues. Essentially, the airlines assume the financial risk of operating and maintaining the terminal buildings. For the Terminal cost center, costs are divided by the leasable terminal building area (to get a cost per sq. ft.) and then allocated to the individual airlines depending on how much area each airline leases from the Port. Operating and capital costs recoverable through airline rates and charges also include costs of capital improvements, including financing costs, except on capital projects funded using Airport Improvement Program (AIP) grants or Passenger Facility Charges (PFCs), or unless otherwise prohibited by federal law.

The Airfield and Ramp cost center operates in a similar fashion. For example, in the Airfield and Ramp cost center, costs are allocated to individual airlines based on landed weight (i.e., weight of the specific aircraft times the number of operations of that aircraft type in each accounting period).

Rates and charges for these cost centers are based on the recovery of actual, audited net costs for the most recently completed fiscal year. For example, calendar year 2005 airline rates and charges are based on fiscal year 2004 (July 1, 2003, through June 30, 2004) audited data.

**Compensatory Cost Centers**

The following cost centers are compensatory: IAB, Ground Access and Parking, Leased Area / Cargo / OMC Hangar, and North Field. The Port negotiates lease amounts and other charges to cover its fully allocated costs of providing facilities subject to market conditions, and assumes the financial risk associated with operating and maintaining the facilities. For example, the Port leases to the air cargo airlines, such as FedEx and UPS, certain facilities (e.g., buildings) at South Field. The Port charges airline passengers for parking on the Airfield parking lots and commercial vehicle operators for accessing the Airfield to pick-up airline passengers. The Port attempts to set lease amounts, fees, charges, etc., to cover its fully allocated costs for these facilities, including depreciation and for major maintenance or improvement projects. The airlines and other tenants pay only for facilities that they use and the Port keeps revenues to offset its direct costs, pay other Airport operating costs, and invest in its facilities (referred to as internal cash flow).

The largest compensatory cost center is Ground Access and Parking, which generated almost $44.5 million in revenue in fiscal year 2004, or about 41% of all Airport revenues.

**Rates and Charges**

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### Summary of South Field Operating Revenues and Expenses – Fiscal Year 2004

<table>
<thead>
<tr>
<th>Gross Terminals(1)</th>
<th>Contract Fueling</th>
<th>Airfield and Ramp</th>
<th>Ground Access and Parking</th>
<th>Leased Area, Cargo, OMC Hangar</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>$36,831,000</td>
<td>$2,137,000</td>
<td>$17,787,000</td>
<td>$44,480,000</td>
<td>$108,933,000</td>
</tr>
<tr>
<td>Percent of Total Revenues</td>
<td>33.8%</td>
<td>2.0%</td>
<td>16.3%</td>
<td>40.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Expenses(2)</td>
<td>38,788,042</td>
<td>2,256,038</td>
<td>18,709,782</td>
<td>32,555,394</td>
<td>97,749,197</td>
</tr>
<tr>
<td>Net Revenues (Loss)</td>
<td>($1,957,042)(3)</td>
<td>($119,038)(3)</td>
<td>($922,782)(3)</td>
<td>$11,924,606</td>
<td>$11,183,803</td>
</tr>
</tbody>
</table>

(1) Includes IAB; (2) Includes actual and allocated expenses; (3) In the residual cost centers, net revenues do not equal 0 because the airlines are charged on a calendar year basis and the revenues/expenses are for a fiscal year (in the table above, for fiscal year 2004). Also, airline rates and charges are in terms of $ per sq. ft. for Terminals cost center and $ per 1,000 pounds of landed weight for Airfield and Ramp cost center. Net revenues are based on estimates of area leased to the airlines, landed weights, non-airline revenues, etc. Actual leased area, landed weights, non-airline revenues, etc. will vary from these estimates, resulting in net revenues that are greater or less than 0.

### Summary of South Field Operating Revenues and Expenses

Table 7.1 summarizes operating revenue and expenses by South Field cost center for fiscal year 2004 (July 1, 2003, through June 30, 2004).

### Airline Cost Per Enplaned Passenger

A common way to examine total airline rates and charges is on a “per enplaned passenger” basis. As described above, airlines operating at OAK reimburse the Port for costs (expenses) associated with providing and maintaining terminal buildings (Terminals cost center) and taxisways and runways (Airfield and Ramp cost center), less any non-airline revenues generated by the Port in these cost centers. Individual airlines pay in proportion to the airport’s use of Airport facilities. The cost to the passenger airlines for operating at the Airfield (i.e., expenses collected in the Terminals and Airfield and Ramp cost centers, less any non-airline revenues) can be divided by the number of enplaned passengers to compute the average airline cost per enplaned passenger. That is, the airline cost per enplaned passenger is the total amount the passenger airlines pay the Port on average for each enplaning airline passenger. It is important to note that the passenger airlines do not pay the Port based on cost per enplaned passenger; the airlines reimburse the Port for expenses collected in the Terminals and Airfield and Ramp cost centers, less any non-airline revenues. Airline cost per enplaned passenger is simply a calculated number that is useful for various analyses, comparisons, etc., as described below.

The airline cost per enplaned passenger can be compared to industry averages, other airports, other airline costs, air fares, and can be used to evaluate the financial impact on airlines of increasing (or decreasing) airport operating expenses in the Terminals or Airfield and Ramp cost centers (e.g., a major taxiway maintenance project or debt service on a new or remodeled terminal building). When comparing an airport’s airline...
cost per enplaned passenger to industry averages or to other airports, it is often difficult to get an “apples to apples” comparison because each airport collects costs in different cost centers and those cost centers may or may not be in the airline rate base. For example, at OAK, the Ground Access and Parking cost center is not part of the airline rate base (but it could be at another airport).

Table 7.2 shows the calculation of airline cost per enplaned passenger at OAK.

As shown in the table above, the passenger airlines pay the Port approximately $4.79 on average per enplaning passenger through terminal rent (Terminals cost center) and landing fees (based on landed weight, through the Airfield and Ramp cost center). At airports nationwide, airline costs per enplaned passenger range from under $3 to over $15.

Increasingly, airlines are struggling to reduce operating costs, including the costs that they pay to airports. Many passenger airlines are struggling financially and some are in bankruptcy. Airports must constantly evaluate and justify increases in operating costs that impact the airline cost per enplaned passenger. In some instances, if the cost to the airlines for operating at a particular airport becomes too great, an airline might choose to discontinue or reduce air service at the airport, or move flights to another less expensive airport (if there is another airport in the region). As do other airport operators, the Port attempts to balance the need to operate and maintain its existing facilities and develop new ones, with the need to maintain airline costs at a reasonable level in order to serve community demand for air service and mix of airlines.

Other Important Regulations and Requirements

Accounting, Financial Reporting, and FAA Regulation of Rates and Charges — Like other local government agencies, the Port follows Generally Accepted Accounting Principles (GAAP) and Government Accounting Standards Board (GASB) regulations for audits of its financial statements. The Port and Airport operators are also subject to Federal Aviation Administration (FAA) accounting and financial reporting requirements. The FAA regulates how airports set airline rates and charges and determine aeronautical revenues.

Revenue Diversion — The Airport and Airway Improvement Act (AAIA) prohibits revenue diversion. Essentially, all revenues generated by an airport must be expended by the airport owner / operator for capital or operating costs of the airport. Also, when an airport owner / operator receives a grant from the federal government, the FAA requires that the airport owner / operator agrees to a grant assurance that all revenue generated by an airport, including local taxes on aviation fuel, be expended by it for capital or operating costs of the airport, the local airport system, other local facilities owned or operated by the airport that are directly and substantially related to the actual air transportation of passengers or property, or noise mitigation purposes on or off the airport. Revenue diversion may include payments for services and/or facilities not provided or not reflective of airport use, use of revenues for general economic development / marketing / promotional activities, payments to compensate for lost tax revenues, and loss of revenue when airports charge non-airport-related entities less than full market value for leased space or property. The FAA ensures compliance by (1) airport self-certification (i.e., in grant applications), (2) audits, and (3) third party complaints. Penalties for revenue diversion include withholding of grants and civil penalties.

7.2.4 Capital Improvement Program

In addition to an operating budget, the Port maintains a Capital Improvement Program (CIP) and funds capital projects, including major maintenance and construction of new airport facilities. The Port’s overall CIP includes approximately $1.23 billion in projects from fiscal year 2002 through 2007. Approximately $671 million of the total CIP are aviation-related projects. As of June 30, 2005, the Port estimates that approximately $347 million in aviation-related projects are still to be completed.

Generally, the Port can pay for capital improvements using grants, Passenger Facility Charges (PFCs), Customer Facility Charges (CFCs), debt financing...
(e.g., bond) proceeds, Port cash (from internal cash flow), and/or tenant or third party financing, subject to various requirements and restrictions that vary from project to project.

Airport Improvement Program (AIP)

The Airport Improvement Program (AIP) is an FAA-administered grant program established by the Airport and Airway Improvement Act of 1982 (originally dating back to 1970 in various laws and forms). The FAA provides AIP grants to airport owners/operators for airport construction and safety projects. AIP grants are funded from the Airport and Airway Trust Fund, which gets its revenue from user taxes on airline passenger tickets, aviation fuel, and air cargo. In addition to AIP grants, the Trust Fund pays for FAA operating costs (e.g., costs associated with operating the air traffic control system) and air traffic control system upgrades.

In federal fiscal years 1992 through 1997, the FAA awarded almost $9.8 billion in AIP grants to airport owners/operators. Almost 75% of these grants were for airside projects, such as construction or reconstruction of runways, taxiways, aprons, and safety improvements. In federal fiscal year 2004, the Port received $13.3 million in AIP grant funding for a variety of projects, including $2 million for sound insulation. From federal fiscal year 2001 through 2004, the Port received $13 million in AIP grant funding for sound insulation. AIP grants pay for up to 80.59% of the eligible costs of eligible capital projects at OAK.

AIP grants can be used for airport planning, airport development, or noise compatibility projects. Grants for airport development generally focus on projects associated with construction, improvement, and preservation of airport infrastructure, or the acquisition of land or equipment. Typical work items included under AIP development are (1) site preparation, (2) construction, alteration, or repair of runways, taxiways, aprons, and ground access roadways on airport property, (3) construction and installation of lighting, utilities, navigational aids, and aviation weather-related reporting equipment, (4) safety equipment required for certification of an airport facility, (5) security equipment required by rule or regulation, (6) snow removal equipment, (7) limited public-use terminal development at commercial service airports, (8) equipment to measure runway surface friction, (9) land acquisition, and (10) aircraft noise mitigation. AIP grants have not been made available for routine maintenance, construction of hangars, and revenue-producing public parking areas.

AIP grants are either entitlement or discretionary. Entitlement funds are awarded to airport owners/operators through a formula, based on the number of enplaning passengers and cargo tonnage. Discretionary funds are intended to provide flexibility for the FAA to meet important national airport system needs. They are used to fund capacity enhancement, noise abatement and compatibility projects, and safety and security improvements.

AIP funds are distributed as a grant (reimbursed as funds are expended by the airport owner/operator) or under a Letter of Intent (LOI). An LOI is a document that conveys the FAA’s intention to obligate AIP funds to an airport for a specific project over a multi-year period (because the federal budget is only appropriated on a 1-year cycle). With an LOI, an airport can begin a project using bonds or short-term loans with the expectation of receiving reimbursement as the project progresses. The Port does not currently have any LOIs.

In order to obtain AIP funds, the FAA requires an airport to have a 5-year Airport Capital Improvement Program (ACIP), which details and prioritizes the airport’s capital improvement needs for AIP funding. The ACIP is updated annually. The Port’s ACIP for OAK includes projects such as reconstructing taxiways and aprons around Terminals 1 and 2 and at North Field, Runway Safety Area (RSA) improvements, storm water management / drainage improvements, and in the outer years, potential construction of taxiway improvements identified in the master plan.

State / Local Government Grants

Like other local government agencies in the San Francisco Bay Area and Alameda County, the Port can apply for and receive grants for the design and construction of transportation projects (usually roadways or transit projects) from the Alameda County Congestion Management Agency, the Metropolitan Transportation Commission, and the Alameda County Transportation Improvement Authority (which administers the Measure B sales tax revenues for Alameda County transportation projects). These grants can have both federal funds (e.g., from the Transportation Equity Act for the Twenty-First Century (TEA-21)) and state funds (e.g., from the State Transportation Improvement Program (STIP)). For example, in fiscal year 2002, the Port received a grant for $1.5 million (a combination of federal and state highway funds) for the construction of Langley Street at North Field and related improvements (including a traffic signal) on Doolittle Drive (State Route 61). Also, the Port received a Measure B sales tax grant for over $70 million to design and construct the Airport Roadway Project, which includes improvements to 98th Avenue and Airport Drive and construction of the cross-Airport roadway, now Ron Cowan Parkway.

Passenger Facility Charges (PFCs)

Passenger Facility Charges (PFCs) are imposed on enplaning passengers when approved for a project, usually $3 or $4.50 per enplaning passenger, in accordance with FAA regulations. PFCs are collected by the airlines when passengers purchase tickets, and forwarded to the airport owner/operator, less a handling charge. To be eligible for PFC funding, a project must (1) preserve or enhance capacity, safety, or security, (2) reduce noise or mitigate noise impacts, or (3) enhance airline competition. PFCs are considered local (not federal) funds, but the FAA still approves the imposition and use of PFCs, and PFC-funded projects require consultation with the airlines. Like AIP grants,
PFCs may be used to construct non-exclusive use terminals and related facilities, but excludes certain revenue-producing portions, such as concessions, parking facilities, rental car facilities, etc.

In federal fiscal years 1992 through 1997, the FAA approved collection of over $16.1 billion in PFC collections by airport owners/operators. Almost 29% of these PFC collections have been used to fund land-side construction (mostly terminal buildings), 17.1% for construction of airside projects, 10.6% for construction of on-airport roads, and 6.1% for construction of noise mitigation projects. The Port collects PFCs at $4.50 per enplaned passenger. PFCs may not be collected on airline tickets purchased with frequent flyer miles, and airports collecting PFCs must be in compliance with the Airport Noise and Capacity Act of 1990 (ANCA). If PFCs are collected at $4.50 per enplaned passenger, the airport owner/operator must forgo 75% of its AIP entitlement funds.

Customer Facility Charges (CFCs)

Under Section 1936 of the California Civil Code, the Port, along with certain other airports in California, may collect a single, fixed Customer Facility Charge (CFC) of $10 on each rental contract from rental car companies that operate concessions at the airport. CFC revenues are to be used only to finance the design and construction of consolidated airport rental car facilities and the design, construction, and provision of common use transportation system that moves passengers between the airport terminals and consolidated rental car facilities, including debt service and other financing costs on bonds issued to finance such projects. Effective April 2002, the rental car companies operating at the Airport are required to collect a $10 per transaction CFC from their rental car customers. CFCs currently generate approximately $7.5 million in revenue each year.

Debt Financing

The Port has the ability to finance capital projects by borrowing money and incurring either short-term or long-term debt. The Port has covenanted that it will not pay any general obligation bonds of the City of Oakland out of the Port's gross revenues as long as its revenue bonds are outstanding. Financing options currently available to the Port include revenue bonds and short-term debt, such as commercial paper.

General Obligation Bonds — As stated above, the Port is currently restricted from supporting any general obligation bonds of the City of Oakland with its revenues. General obligation bonds, which usually require voter approval, pledge the full faith and credit of a municipal entity, such as the City of Oakland, as security to the investor. This commitment is based on the entity’s ability to levy property, sales, or income taxes. The entity gives the bondholders (investors) a first claim on its general fund, and the community pledges the ability to pass any legislation needed to increase general fund revenues to pay the debt service. The citizens of Oakland approved general obligation bonds backed by the City’s general credit for harbor development in 1925 and for Airport development in 1953 (for construction of South Field). The Port has repaid all principal and interest on these bonds, and has not had any outstanding general obligation bond debt for its benefit since 1968.

Revenue Bonds — Revenue bonds are issued by an airport owner/operator for projects that are anticipated to generate sufficient revenue to pay the debt service. Unlike general obligation bonds of a municipal entity, they are backed by a specific source or sources of revenue. They do not usually require voter approval. However, because the payment of debt service is limited to the revenue generated by the project, a feasibility study analyzing the projected revenues and operations of the facility being financed or improved is typically required to market and sell the bonds.

Revenue bonds may be issued tax-exempt for qualifying projects, including terminals, runways, hangars, repair shops, and land-based navigational aids. Construction of facilities such as airport hotels, retail facilities, industrial parks, and commercial office buildings on-airport, generally do not qualify for tax-exempt status. Generally, most types of airport projects can be financed using revenue bonds. At OAK, for example, airline rates and charges (i.e., terminal lease rates and landing fees) are set to include debt service on terminal projects (Terminals cost center) and airfield projects (Airfield and Ramp cost center) to repay any revenue bonds issued for terminal or airfield projects.

From time to time, the Port has issued revenue bonds to finance or refinance its maritime and aviation capital projects, as well as certain commercial real estate projects. The Port’s revenue bonds are not secured on a project by project basis or from specific project revenues; they are secured by the Port’s gross revenues, excluding proceeds from certain restricted sources (collectively, the “Pledged Revenues”). As of May 31, 2005, the Port’s revenue bonds were outstanding in the aggregate principal amount of $1.4 billion. The Port has covenanted not to issue any additional bonds or other obligations payable from or secured by a lien on the Pledged Revenues if such bonds or obligations would have claims or security interest superior to that of the currently outstanding revenue bonds. The Port may, however, issue additional revenue bonds with parity claim or security in the Pledged Revenues if certain requirements are met.

Revenue bonds may also be issued and backed by PFCs, either alone (stand-alone) or in combination with other sources of airport revenue (called double-barreled bonds). To date, the Port has not issued any PFC-backed revenue bonds.
Short-Term Debt — The Port established a Commercial Paper Program in 1998 for the purpose of providing interim financing of the Port's CIP during the construction period. Commercial Paper is a short-term (usually less than 270 days), variable interest loan, which is typically “rolled” for an ensuing term at its maturity. The Port’s Commercial Paper Program is authorized to be issued in a principal amount not to exceed $300 million. The Port is required to maintain a letter of credit meeting certain requirements to secure the payment of the Commercial Paper as long as any Commercial Paper is outstanding. As of May 31, 2005, the total principal amount of the Port’s Commercial Paper outstanding is $150 million.

Tenant or Third Party Financing
The Port may elect to use tenant or third party financing for capital projects. For example, the Port might lease a parcel at the Airport to a tenant to construct a hangar or cargo facility. The Port collects ground rent for the duration of a long-term lease (usually 20 or more years). At the end of the lease, the capital improvements constructed by the tenant usually become the property of the Port. If the case of third party financing, the third party leases the parcel from the Port, constructs the improvements, and then rents them to one or more tenants.

7.2.5 Reference Materials
The following reference materials were used in preparation of Section 7.2:
- Port Ordinance No. 3634 (adopted April 3, 2001), as amended
- Airport Finance (Powerpoint slides), Leigh Fisher Associates
- 2002 Hub Factbook (Figure 2, Airport Hub Key Statistics Summary), Salomon Smith Barney, April 15, 2002
- American Association of Airport Executives (AAAE) Accreditation and Certification Programs, Body of Knowledge Module 9 (Airport Fees, Rate, and Charges) and Module 10 (Capital Development and Funding for Airports), 2004/2005

7.3 Financial Plan
A financial plan was prepared to determine if the potential master plan projects are fundable. Like individuals and other local government agencies, the Port has to live within its financial means. Therefore, if any of the potential master plan projects are well beyond the ability of the Port to pay for them, then they do not need any further study and would not be recommended in the master plan. As described above, the Port can pay for capital projects using a number of potential funding sources, such as AIP grants, PFCs, Port cash, and debt financing (i.e., borrowing money and paying it back over time using anticipated future revenues). The financial plan presented here represents one possible funding scenario, which might change in the future as facts and assumptions change and present themselves if and at the time the Port actually pursues any of the projects.

The basic steps used to prepare the financial plan are as follows:
1. Estimate how much the potential master plan and other capital improvement projects might cost (including escalation),
2. Estimate potential revenues that might be available to pay for these projects, and
3. Evaluate if there are enough potential revenues (now and bonded over time) to pay for the projects.

Table 7.3 summarizes potential master plan and non-master plan projects, including those projects not yet constructed from the Airport Development Program (ADP), and what they might cost, escalated to account for inflation and anticipated increases in the cost of construction materials (wood, steel, asphalt, concrete, etc.), and labor. The rough, order-of-magnitude costs presented in Table 7.3 are assumed to be all-inclusive, including soft costs (design, construction and program management, etc.) and environmental mitigation costs, if any.

Table 7.3: Potential Projects and Costs

<table>
<thead>
<tr>
<th>Potential Projects</th>
<th>Figure</th>
<th>Estimated Cost (escalated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal (in terminal development Area 2)*</td>
<td>Figure 4.6 (example only)</td>
<td>$1,070,000,000</td>
</tr>
<tr>
<td>Runway 29 Access Improvements</td>
<td>Figure 5.2</td>
<td>$21,000,000</td>
</tr>
<tr>
<td>New Runway 29 High-Speed Taxiway Ext</td>
<td>Figure 5.3</td>
<td>$28,000,000</td>
</tr>
<tr>
<td>Other Capital Improvement Program Projects*</td>
<td>None</td>
<td>$395,000,000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$1,328,000,000</td>
</tr>
</tbody>
</table>

* Includes relocation of the cargo building and other functions in that building to the Oakland Maintenance Center site, a new taxiway parallel and west of Taxiway B, and a new parking garage. (1) Includes other Capital Improvement Program projects not specifically discussed in the master plan, such as seismic upgrade of Terminal 1 improving Runway Safety Areas (RSA), renovation of existing airfield pavements and on-Airport utility systems, and ADP projects not yet constructed.
While each project would have its own timeline for implementation, it is assumed that these projects would start within a few years (after appropriate environmental reviews, detailed financing plans, and designs are complete) and be more or less complete by 2013.

The next step is to estimate potential revenues that might be available to fund these projects. Through 2013, it is estimated that the Port might be able to generate approximately $440,000,000 in PFCs, AIP grants, airline rates and charges (increment dedicated to capital projects, as opposed to operations and maintenance costs), and cash. Therefore, the Port cannot afford these projects without borrowing against anticipated future revenues (i.e., selling revenue bonds backed by PFCs, airline rates and charges, and Port cash).

Through 2040, it is estimated that the Port might be able to generate almost $5,000,000,000 in PFCs (41%), airline rates and charges (38%), and Port cash (21%), which could be available for bonding (borrowing against). The following presents some basic assumptions about this estimated revenue stream:

- An overriding goal is to keep airline rates and charges at a reasonable level (see discussion on airline cost per enplaned passenger in Section 7.2.3). Therefore, it is assumed that the total airline cost per enplaned passenger would increase to only $8.50 (in 2008 dollars), with increases for inflation, and only between 35% and 40% of this total would be available for bonding to pay for these new projects.
- For the purposes of calculating revenues generated from airline rates and charges and PFCs, it is assumed that the maximum number of airline passengers that will use OAK on an annual basis is just over 22 MAP due to capacity limitations of OAK’s main air carrier runway (Runway 11-29). Because there is no absolute runway capacity (i.e., delays just continue increase as flights are added), it may be possible that the actual number of airline passengers could continue to grow slightly each year (e.g., 1% beyond 22 MAP. Also, the passenger airlines could decide the “upgauge” their fleet (use new aircraft that seat more passengers), in which case they could carry more airline passengers without generating additional operations and runway delay. However, for the purposes of the financial plan, the number of airline passengers is assumed to be limited to just over 22 MAP. It should be noted that airline passenger facilities, such as a new terminal, are not being planned for 22 MAP (as discussed in Chapter 4, new terminal facilities were studied to accommodate 18 to 20 MAP in the 2010 to 2012 timeframe). However, for debt financing (bonding) purposes, it is necessary to look at potential revenues well beyond the planning horizon (in this case, out to 2040).
- The amount of future Port cash (e.g., net parking revenues) that could be pledged to pay the projects in the above table is limited to between $20,000,000 and $35,000,000 each year, which is conservative (i.e., there might be additional Port cash available each year). However, cash over and above this could be used to pay for other, unanticipated projects not included in the master plan projects or in the other Capital Improvement Program projects.
- It is assumed that about $70,000,000 in AIP grants would be available between 2007 and 2013 to directly offset the costs of the projects summarized in Table 7.3. These grant funds may or may not actually be available.

With these project costs and revenue assumptions, it appears that these master plan projects could be affordable, based on a rough, high-level debt capacity analysis. The analysis assumed that bonds would be sold in two issuances at a 5.5% interest rate. Further, the analysis assumed a coverage ratio of 1.4 (i.e., the Port has to demonstrate that it can generate 40% more revenue than it will take to pay back the bonds).

As described above, this financial plan is only intended to provide an indication that these projects might be affordable. Additional work would be required to refine the port cost estimates and schedules, as well as refine and further develop the Port’s future revenue projections. Moreover, more detailed analyses must consider the overall Port finances, not just those of the Airport.

As a reminder from the beginning of this chapter, the financial plan is not intended to give a comprehensive assessment of the Port or Airport for purposes of making investment or other decisions. The information contained in this chapter (like information contained in the other chapters) will change over time, and no obligation to update or revise it is created. Any potential investor in the Port’s long-term or short-term debt should review appropriate disclosure documents provided by the Port in connection with such debt, and should not rely on the master plan or this chapter in making investment decisions.
8.1 Introduction

This chapter summarizes the recommended potential development areas from Chapters 4 and 5 on land-use maps. The land-use maps show the recommended development pattern on the Airport for the 2010 to 2012 timeframe (the near-term planning horizon) and for 2025 (the long-term planning horizon). The chapter then summarizes the near-term master plan projects that are recommended for further study and outlines other anticipated near-term (and some longer-term) projects.

FAA AC No. 150/5070-6A, Chapter 9 (Airport Plans), Section 1 (General), states that “Upon completion of the requirements analysis . . . the master planning proceeds to the synthesis of airside and landside concepts and the development of plans.” In determining the appropriate level and type of plans for the OAK master plan, the following principle, as outlined in the AC, was used: “The information presented in this AC covers the planning requirements for all airports, regardless of size, complexity or role. However, the scope of study must be tailored to the individual airport, with the level of effort limited to its specific needs and problems. Based on an airport’s specific needs, certain master planning elements may be emphasized while others will not be considered at all.”

Therefore, the land-use maps below represent a synthesis of the potential development for OAK in the 2010 to 2012 timeframe, in accordance with FAA AC No. 150/5070-6A. These maps are subject to change as the Airport and demand for its various facilities evolve over time, especially further into the future (e.g., the long-term / 2025 land-use map). Further, additional environmental review, financial planning, and engineering must be performed before any of the land uses or projects within those land uses could proceed.

8.2 Existing Land-Use Map

Figure 8.1 presents the existing aviation land uses (by color) on the Airport. It is the same graphic presented in Chapter 2 (Section 2.2), Figure 2.1, using the same land-use designations and color scheme. It is presented again here for comparison purposes.

8.3 Near-Term Land-use Map (2010-2012)

Figure 8.2 presents the forecast land uses in 2010 to 2012. The land-use abbreviations (i.e., A, PF, C, ARS, GA, ARB, R, and U) highlight areas of significant change from the prior land-use map (in this case, changes from Figure 8.1). As shown on the graphic, the primary new land-use designation is a Passenger Facilities (or PF) area east of Taxiway B, north of existing Terminal 1, and south of Ron Cowan Parkway, as recommended in Chapter 4. If a new terminal project is proposed and approved in this area, the Oakland Maintenance Center (OMC) site would be redeveloped to support the new terminal land-use area to the south including replacement air cargo facilities, such as the belly cargo and United Parcel Service building (C land use), potential airline provisioning and GSE maintenance facilities (ARS land use), and remain overnight (RON) aircraft parking and / or passenger / employee vehicle parking (PF land use).

Other new land-use designations in the 2010 to 2012 timeframe include Airfield (or A) land uses for a potential new taxiway parallel to Taxiway B, a potential new high-speed taxiway off Runway 29 (shown as Taxiway Z), and potential new Runway 29 taxiway access improvements, as described in Chapter 5. The PF land use on the west side of Taxiway B, just south of Ron Cowan Parkway could be for RON aircraft parking, and the PF land use in the Central Basin, just south of Ron Cowan Parkway could be for long-term / remote airline passenger vehicle parking and / or employee parking.

At North Field, new land uses are designated for general aviation aircraft parking ramps and / or hangars (GA land use). The area just north of Runway 15-33 could be used for larger corporate jet parking, while the area adjacent to Harbor Bay Parkway could be used for hangars for small (e.g., single-engine or light multi-engine) aircraft hangars. It is anticipated that these areas would be developed only as market conditions warrant using a third party developer model. The amount of area shown is consistent with the requirements for potential general aviation development (see Chapter 4).

8.3.1 Summary of Near-Term Master Plan Projects Recommended for Further Study

This section presents a summary of the near-term master plan projects recommended for further study as a result of the analyses in Chapters 4 and 5 and the screening-level environmental and financial analyses presented in Chapter 6 and 7. This master plan is a planning and feasibility study, and is therefore not intended to be used by the Port to approve any specific projects. Further development and refinement of the recommended near-term projects is required, including financial planning, engineering, and detailed environmental reviews, before the Port could decide whether to pursue them.

The following are the master plan projects recommended for further study. These projects should continue to be developed by the Port, including additional planning, financial feasibility and funding, preliminary engineering, and detailed environmental review:

1. (1) 17 to 21-gate airline passenger terminal, which might include a new parking garage, in potential terminal development Area 2, on a total of 46 to 50 aircraft gates as accommodated 18 to 20 MAP in the 2010 to 2012 timeframe at a reasonable level of service,

2. Relocation of the cargo building and other functions to the Oakland Maintenance Center site south of Ron Cowan Parkway (UPS has expressed interest in this location, whether or not a new terminal is constructed in Area 2),
(3) New taxiway parallel and east of Taxiway B, generally between Taxiways T (or possibly Taxilane S) and B2 (this project solves most of the congestion and delay issues associated with head-to-head taxi events on Taxiway B and supports the potential new terminal in Area 2).

(4) Taxiway access improvements to Runway 29, including a taxiway parallel to Taxiway U (between Taxiways T and W) and W (between Taxiways U and the Runway 29 threshold).

(5) New high-speed taxiway exit from Runway 29 between high-speed Taxiways V and Y, and

(6) Airline passenger or employee vehicle parking in the non-wetlands area of the Central Basin (off Ron Cowan Parkway near Harbor Bay Parkway).

In addition to these projects, it is recommended that Port staff and the Stakeholder Advisory Committee continue to work together on the following projects and studies:

- Continue to study a potential Runway 29 aircraft noise barrier, on-Airport, which would provide some aircraft noise reduction for the homes on the west side of Neptune Drive in the City of San Leandro under certain, limited conditions, or other methods to reduce the effects of aircraft noise in the community (including the City of Alameda), and continue to work with the City of San Leandro on their residential sound insulation program, which is currently underway.
- Conduct a study to investigate why some corporate jets (less than 2%) choose not to comply with the Port's voluntary noise abatement procedures, which requests that they taxi to and depart from South Field instead of North Field (except those that can depart on Runway 33).
- Conduct an Airport ground traffic study (work with the cities of Alameda, San Leandro, and Oakland to develop a study to determine the amount of traffic to/from the Airport, including trucks, that uses local streets in these cities).
- Establish a committee (i.e., continue the Stakeholder Advisory Committee after the master plan, with a new name, so that the Port's Planning and Development staff can continue to meet, annually or semi-annually, with community stakeholders and Airport-users to provide updates on various projects and Airport activity, as well as receive input).
- Continue the Port's commitment to other environmental programs, such as those outlined in Chapter 6, including continued operation of AirBART (until the BART Connector can be constructed) and funding for the BART Connector project.

8.3.2 Other Anticipated Near-Term Projects

In addition to the projects outlined in Section 8.3.1, the Port anticipates needing to undertake the following near-term renovation, maintenance, and safety projects (not included in the master plan). This list is representative, not comprehensive, and may not include all of the projects that the Port might need to undertake in the future.

- Airfield pavement renovation / rehabilitation / reconstruction, as follows:
  - East and West Aprons (around Terminals 1 and 2, on-going)
  - Taxiway T between Taxilane S and Taxiway U (with East Apron)
  - Taxiway B (South Field)
  - Runway 11-29 (in approximately 2015)
  - Apron at Hangars 1 through 5 (North Field, on-going)
  - Other North Field aprons, taxiways, and roadways
  - Runway 15-33 (requires cost-benefit analysis)
  - Others as determined by the Port's pavement management system
  - Infield Roadway (North Field)
  - Utility system and airfield lighting rehabilitation and upgrades
  - Runway Safety Area (RSA) improvements (all runways)
  - Storm water system rehabilitation and upgrades
  - Runway 11-29 perimeter levee seismic strengthening
  - Airport-wide security system upgrades and expansions
  - Terminal 1 rehabilitation (including seismic and utility system upgrades)
  - FAA air traffic control tower
  - FAA navigational aid upgrades (e.g., replacing the VOR at North Field with a new one using doplar to improve accuracy and reduce interference)
8.4 Long-Term Land-Use Map (2025)

Figure 8.3 presents the forecast land uses in 2025. The land use abbreviations highlight areas of significant change from the prior land-use map (in this case, changes from Figure 8.2). The graphic shows an expansion of the PF land-use designations in and around the existing terminal area, mostly to support potential additional remain overnight (RON) aircraft parking and some potential airline passenger and/or employee vehicle parking. The graphic also shows additional expansion of GA land-use designation at North Field, mostly for potential additional small aircraft or corporate jet hangars (consistent with the requirements developed in Chapter 4). Although potential land uses are shown, no specific projects are identified for this time period, which would be too speculative and not reasonably foreseeable that far into the future.

A new runway at South Field (parallel to Runway 11-29) is not shown on this figure, although one would likely be required before 2025 to meet anticipated unconstrained demand at OAK. As discussed in Chapter 5, it is recommended that the Port not pursue a new South Field runway at this time due to environmental and financial constraints. However, it is recommended that the Port work with its regional partners (e.g., the Regional Airport Planning Committee) to continue discussions about the future demand and capacity of runways at Bay Area airports. Providing additional runway capacity for the Bay Area should be discussed and decided by the entire region.
Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and is for planning purposes only. It does not represent any particular course of action (it might represent an idea or concept that was discarded) and must be interpreted in the context of the entire master plan document.
Important Note: This graphic depicts potential airport land uses in the 2010 to 2012 timeframe at Oakland International Airport (OAK). This drawing is part of the study and is conceptual in nature, the Port may or may not actually propose any of the uses depicted in the graphic or service the terminologies referenced. Whether any land use will be proposed is subject to a number of factors, including market conditions, availability of funding, environmental constraints, etc. Each individual land use depicted may be independent of or may be related to other uses.

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded) and must be interpreted in context of the entire master plan document.
Important Note: This graphic depicts potential airport land uses in the 2025 timeframe at Oakland International Airport (OAK). This drawing is a part of the study and adoption of a master plan for OAK. Because the master plan is conceptual in nature, the Port may or may not actually propose any of the uses depicted in this graphic or within the timeframe referenced. Whether any land use will be proposed is subject to a number of factors, including market conditions, availability of funding, environmental constraints, etc. Each individual land use depicted may be independent of or may be related to other uses.

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded) and must be interpreted in the context of the entire master plan document.