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 center-line). 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 5 1⁄2-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 take off 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.

Potential Takeoff Noise Barrier Near Source or Receiver

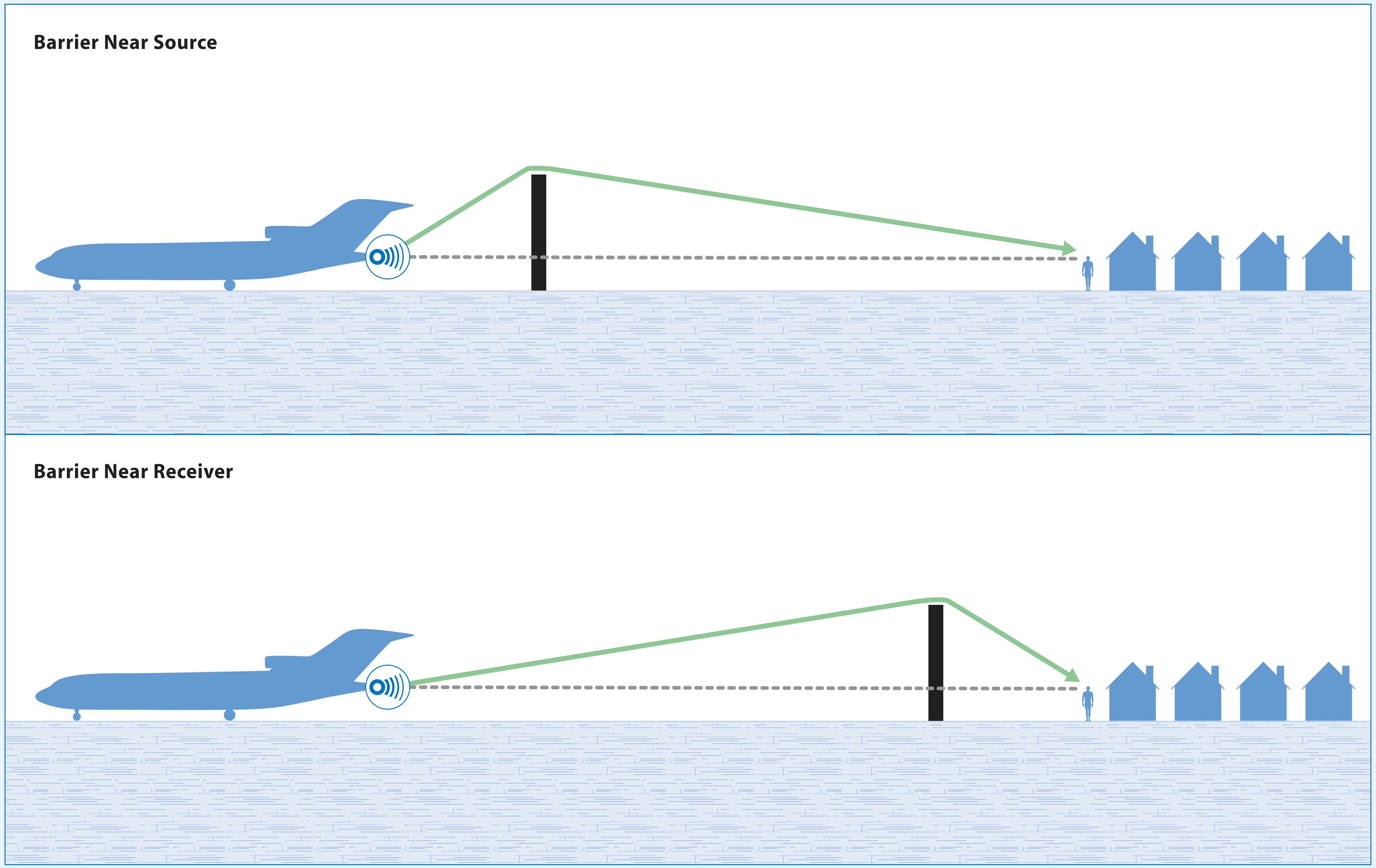


Figure 6.19

Oakland International Airport Master Plan

March 2006

Potential Takeoff Noise Barrier Near Source or Receiver

L E G E N D

- Sound Source
- Sound Direction
- Line of Sight Between Source and Receiver

Note: Graphics are not to scale

PORT OF OAKLAND

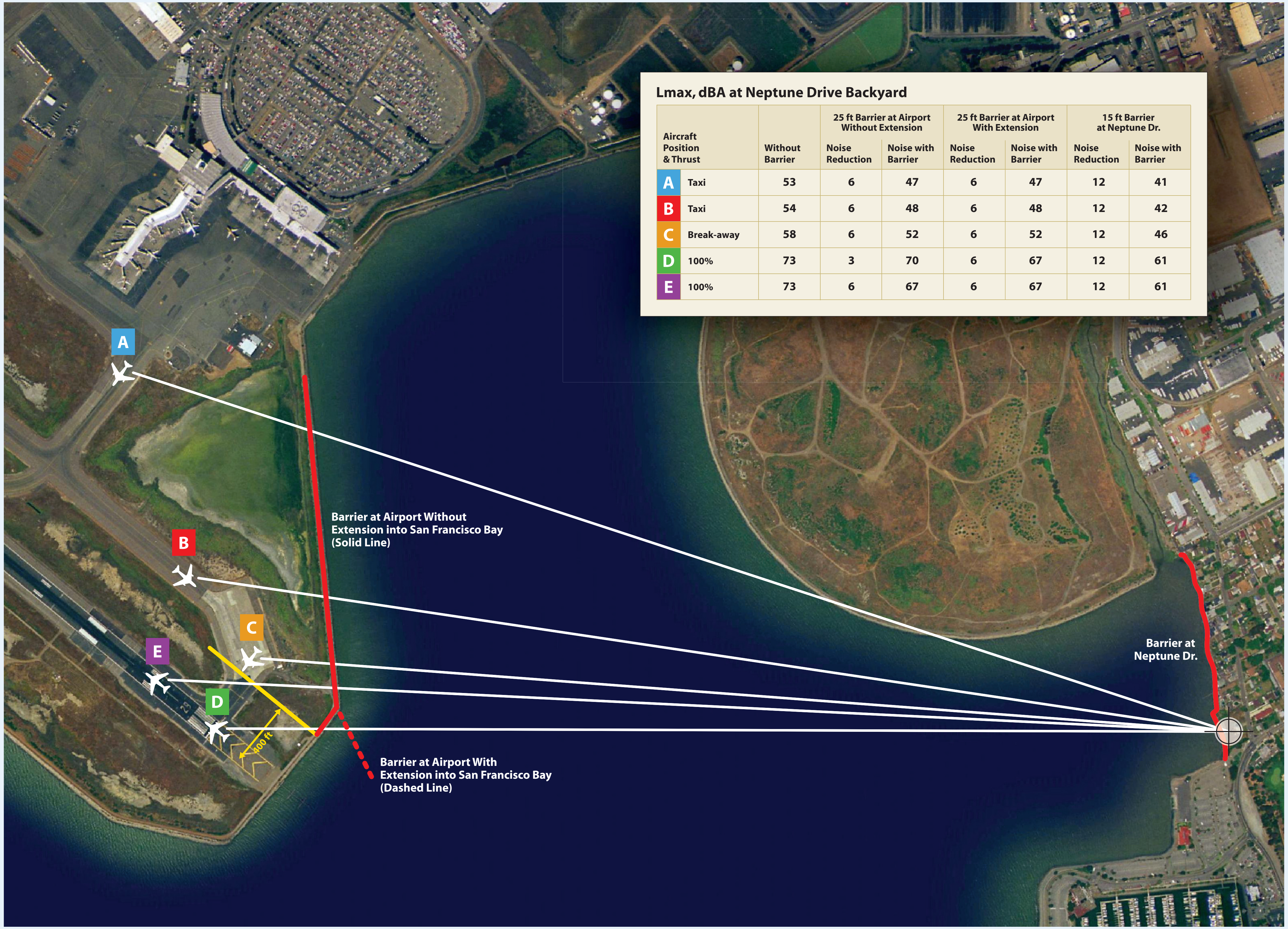
Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action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

Figure 6.20

Oakland International Airport Master Plan

March 2006

Potential Takeoff Noise Barriers



Lmax, dBA at Neptune Drive Backyard

Aircraft Position & Thrust		Without Barrier	25 ft Barrier at Airport Without Extension		25 ft Barrier at Airport With Extension		15 ft Barrier at Neptune Dr.	
			Noise Reduction	Noise with Barrier	Noise Reduction	Noise with Barrier	Noise Reduction	Noise with Barrier
A	Taxi	53	6	47	6	47	12	41
B	Taxi	54	6	48	6	48	12	42
C	Break-away	58	6	52	6	52	12	46
D	100%	73	3	70	6	67	12	61
E	100%	73	6	67	6	67	12	61

L E G E N D

- Potential Barriers
- Potential Barrier Extension
- Object Free Setback

Acronyms

dBA Decibels Adjusted
Lmax Maximum Sound Level

Notes

- 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.

0' 500' 1000'
SCALE

PORT OF OAKLAND

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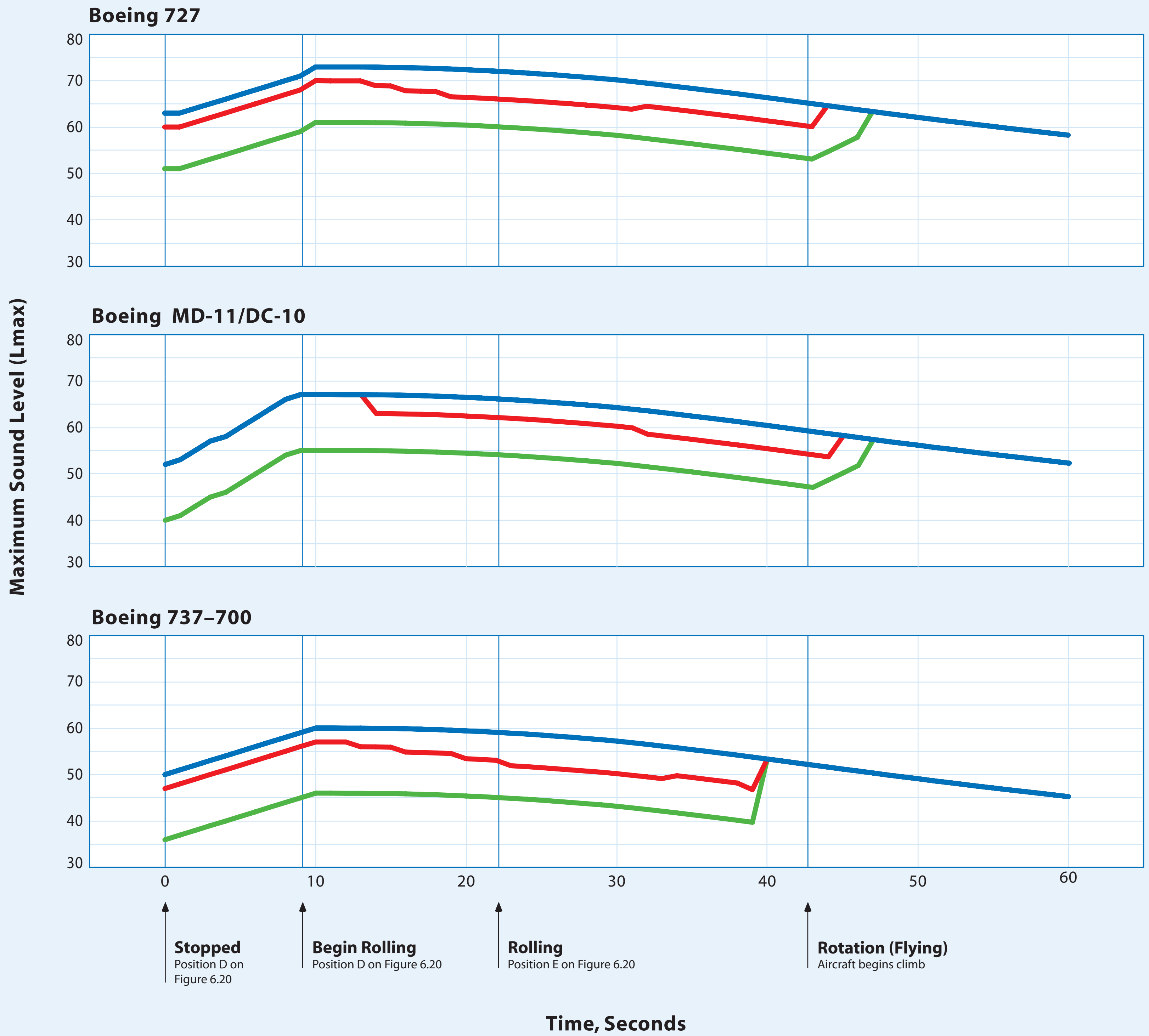
Figure 6.21

Potential Effect of Barrier on Departure Noise

No Wind, Outdoor Noise Level, Neptune Drive Backyard



Boeing 727

	Average Daily Departures		
	Day	Evening	Night
Year 2004	3	1	4
Year 2010	1	0	2

Boeing MD-11/DC-10

	Average Daily Departures		
	Day	Evening	Night
Year 2004	5	1	6
Year 2010	5	1	8

Boeing 737–700

	Average Daily Departures*		
	Day	Evening	Night**
Year 2004	116	37	22
Year 2010	185	32	33

* includes all B737 and A318, A319 and A320 models
** Most night operations of B737 aircraft occur between the hours of 10pm and 11pm and between 6am and 7am

Oakland International Airport Master Plan
March 2006

Potential Effect of Barrier on Departure Noise

L E G E N D

- No Barrier
- With 25' Airport Barrier
- With 15' Neptune Barrier

Time Periods	
Day	7 am – 7 pm
Evening	7 pm – 10 pm
Night	10 pm – 7 am

PORT OF OAKLAND

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