from Troy Brown

Puget Sound Regional Council
PSRC

RESOLUTION A-93-03

A RESOLUTION of the General Assembly of the Puget Sound Regional Council Amending the 1988 Interim Regional Airport System Plan (RASP) for Long-Term Commercial Air Transportation Capacity Needs of the Region

WHEREAS, the Puget Sound Regional Council, designated under federal and state laws as the Metropolitan Planning Organization and Regional Transportation Planning Organization for the central Puget Sound region, is responsible for adopting and maintaining regional growth management and transportation strategies for the region; and

WHEREAS, the Regional Council has adopted VISION 2020: Growth and Transportation Strategy for the Central Puget Sound Region, to guide growth management and transportation decisions and actions in King, Kitsap, Pierce and Snohomish counties; and

WHEREAS, VISION 2020 seeks to assure that the people of this region continue to enjoy an outstanding and improving quality of life that includes a vibrant economy, a healthy environment, and livable communities connected by a multimodal, transit-oriented transportation system that emphasizes accessibility and enables the efficient movement of people, goods and freight; and

WHEREAS, with respect to assessments of commercial air transportation needs, the Regional Council acknowledges long term forecasting uncertainties, and the reduction on a day-to-day basis of current airport capacity at Sea-Tac Airport during bad weather conditions; and

WHEREAS, VISION 2020, as the Regional Transportation Plan for the region, includes the 1988 interim Regional Airport System Plan with language that called upon the region to "proceed expeditiously with the detailed evaluation and selection of a preferred regional air carrier system alternative," and which now needs to be amended to reflect the Regional Council's recent planning and deliberations regarding the long-term commercial air transportation capacity needs of the region; and

WHEREAS, jurisdictions in the region agree to site regional transportation facilities in a manner that reduces adverse societal, environmental and economic impacts; seeks equity and balance in siting and improving the region's transportation system; and addresses regional growth planning objectives; and

WHEREAS, the Regional Council, through the Flight Plan Project, has sought to address policy, environmental, and procedural concerns through a variety of products and processes, including the following:

(a) The Regional Council, acting jointly with the Port of Seattle, completed a non-project Final Environmental Impact Statement evaluating various system alternatives for meeting projected demands and their noise and other environmental impacts, and

(b) The Regional Council conducted a series of workshops, decision meetings, open houses, and a public hearing, to listen to the concerns and suggestions of community groups, individuals and interests that could be affected by a regional commercial air transportation capacity decision; and

WHEREAS, as a part of this effort, the Regional Council finds that commercial air transportation is important to the region's economy, and that additional commercial air transportation capacity needs to be identified and preserved, and implemented when needed at some point in the future; and

WHEREAS, the Regional Council finds that there is no perfect air transportation capacity solution, but that whatever solution is adopted must be part of an integrated transportation system that includes air and marine transportation as well as roadways and rail, that demand management and system management should be utilized to make the most efficient use of the existing system, and that any solution must not result in a decrease in safety and must address noise; and

WHEREAS, the Regional Council further finds that the adopted solution should be flexible, must be consistent with the growth management planning that is occurring in the region, and should be financially feasible; and

WHEREAS, the Regional Council Transportation Policy Board and Executive Board have developed and refined this recommendation to the Regional Council General Assembly; and

WHEREAS, this amendment to the interim Regional Airport System Plan is consistent with the VISION 2020 Final Environmental Impact Statement;

NOW, THEREFORE, BE IT RESOLVED that the Regional Council Executive Board recommends that the General Assembly adopt the following elements of a Regional Airport System Plan amendment:

That the region should pursue vigorously, as the preferred alternative, a major supplemental airport and a third runway at Sea-Tac.

1. The major supplemental airport should be located in the four-county area within a reasonable travel time from significant markets in the region.
2. The third runway shall be authorized by April 1, 1996:
   a. Unless shown through an environmental assessment, which will include financial and market feasibility studies, that a supplemental site is feasible and can eliminate the need for the third runway; and

b. After demand management and system management programs are pursued and achieved, or determined to be infeasible, based on independent evaluation; and

c. When noise reduction performance objectives are scheduled, pursued and achieved based on independent evaluation, and based on measurement of real noise impacts.

3. The Regional Council requests consideration by the Federal Aviation Administration of modifying the Four-Post Plan to reduce noise impacts, and the related impacts on regional military air traffic.
4. Evaluation of the major supplemental airport shall be accomplished in cooperation with the state of Washington.
5. Proceed immediately to conduct site-specific studies, including an environmental impact statement, on a Sea-Tac third runway;
6. Eliminate small supplemental airports, including Paine Field, as a preferred alternative.

BE IT FURTHER RESOLVED that the Board is directed to:

1. Take all necessary steps to assure efficient, effective and economical implementation of this resolution.
2. Negotiate with the Port of Seattle, the Washington State Department of Transportation and other responsible agencies, as necessary, to assure the implementation of this resolution.
3. Assure that implementation of this resolution is at all times in compliance with the requirements of all applicable federal, state and local laws and regulations.
4. Report to the General Assembly on the results of its actions at the next regularly scheduled Assembly meeting or at such special meeting of the Assembly as the Board may call.

ADOPTED by the General Assembly this 29th day of April, 1993.

Bill Brubaker, Councilmember
Snohomish County
President, Puget Sound Regional Council

Attest: Mary McCumber, Executive Director

Port of Seattle

October 16, 1995

Mr. Scott P. Lewis, Ms. Martha J. Langelan and
Dr. William Bowlby
Expert Arbitration Panel for Noise
and Demand/System Management
c/o Mr. Jerry Dinndorf
Puget Sound Regional Council
1011 Western Avenue, Suite 500
Seattle, WA 98104-1035

Dear Panel Members:

The Port of Seattle respectfully submits for your consideration the attached response to the information you have requested concerning how the Port is proposing to use its measurements of aircraft noise levels and other evidence to establish that it has satisfied the requirements of Resolution A-93-03 with respect to the reduction of on-the-ground noise impacts associated with aircraft using Sea-Tac. As the Panel requested, we have prepared a written statement of the Port's position regarding those issues specified in the Panel's Notice of Hearing on Phase II Noise Issues, September 19, 1995.

Sincerely,

Patricia Davis
Commissioner, Port of Seattle

cc: PSRC Executive Board Members

Seattle-Tacoma
International Airport
P.O. Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

PORT OF SEATTLE
STATEMENT OF POSITION

The Expert Arbitration Panel has found "that in its efforts to limit and reduce the impact of aircraft-generated noise on its neighbors, the POS [Port of Seattle] has been a leader within the airport industry." (Order on Phase 1 Noise Issues, p. 9).[1] One of the Panel's members said that the Port has been "a national leader in terms of what other airports are doing with noise abatement and noise mitigation." (Transcript of May 5, 1995 hearing, p. 184)[2] The question is whether, while leading the nation on this difficult issue, the POS has also done enough to meet the Expert Panel's standard of achieving "meaningful" reduction in noise impacts.

The Panel interprets the resolution of the Puget Sound Regional Council (PSRC) as follows:

> To meet its burden under the Resolution, as we interpret it, the POS must offer us reliable evidence, based on actual measurements of on-the-ground noise, that by 1996 there has been an objectively measurable, meaningful reduction in aircraft noise impacts in the affected communities surrounding the Airport. (Order, p.1)

That standard, which turns on the meaning the Panel will give to the word "meaningful," is not a clear, numerical standard, nor is it inherently objective. The record in this proceeding amply displays the difficulty which the parties and the Panel are experiencing in reducing this standard to a precise definition. As the Panel has said: "This is the most difficult question." (Order, p. 5)

[1] The Order on Phase 1 Noise Issues is referred to in this document as the "Order."
[2] The May 5, 1995 transcript is referred to in this document as the "Transcript."

This Position Paper proposes a definition of the Panel's "meaningful reduction" standard, and explains the evidence on which the POS intends to rely when it shows (in early 1996) that the requirements of the PSRC Resolution have been fully satisfied.

A. The Heart of the Matter

The POS noise reduction program unquestionably has reduced noise, and has reduced the impact of noise for thousands of people. No objective information, of which the POS is aware, suggests otherwise. Reductions of noise impacts for thousands of people is sufficient to satisfy the PSRC Resolution.

Noise energy on the ground has been substantially reduced since 1990 and in each intervening year because noisier stage 2 aircraft have been retired from the Airport's total fleet, including its nighttime fleet. Quieter planes mean less noise. Noise impacts have been reduced because noise energy and its effects on annoyance and interference with speech, activity and sleep have been reduced, because thousands of structures have been insulated, and because other noise abatement measures have been implemented and enforced.

The POS will show these results using standard, widely-used and accepted methods and research. These proven approaches are well-suited to the analysis required by the PSRC Resolution. The POS will rely on data produced by the permanent and non-permanent noise monitoring sites, which have been designed, sited and operated in compliance with applicable technical and scientific standards. It will apply that data with the well-established, widely-used, and officially-blessed research which correlates the

DNL metric with persons reporting to be highly annoyed by aircraft noise. The Schultz/Fidell curves will be at the heart of the POS case, confirmed by the work of Dr. Henning Von Gierke, one of the world's eminent experts in aircraft noise effects. This research is proven and respected.

Reductions in impacts also will be demonstrated by data with respect to insulation of homes and schools. This data comes directly from the routinely kept and audited records of the POS and is reliable. A consistent pattern of reduction of noise impacts for at least several thousand people will be confirmed by relating the monitoring data to speech, activity and sleep interference, relying on widely-used research, and on supplemental noise metrics, such as SEL and time-above.

The Panel must make an objective determination of reductions in noise impacts. This task has been enveloped in a campaign to prevent construction of a new runway at the Airport. What should be a straightforward analysis, based on the commonly-used tools of the trade, has been transformed into a direct attack on those tools. But the Panel should not ignore or attempt to revise the way airport noise impacts are determined throughout the world. The Panel can answer the question asked by the PSRC Resolution without re-examining the science of airport noise analysis. By the existing, commonly accepted, methods of objective measurement, several thousand people have benefited from the POS noise program. That satisfies the meaning and intent of the Resolution.

B. The Noise Measurements Are Reliable[3]

The Memorandum of Understanding under PSRC Resolution A-93-03 provides that:

> Data to measure on-the-ground noise reduction shall be determined by using the measured aircraft DNL noise data from the Port's Permanent Noise Monitoring System at Sea-Tac Airport.

The amount of data has been increased through the addition of temporary monitoring sites selected in cooperation with communities and by expanding the number of noise metrics to be applied.

The validity of the data produced by the monitoring sites has been reviewed three times in this proceeding: *Noise Validation Methodology in Compliance with PSRC Resolution A-93-03*, July 29, 1994; Response to Question 13 in *POS Response to Expert Panel Request for Information*, February 27, 1995; and, *Methodology for the Measurement and Prediction of Aircraft Noise Levels at Seattle-Tacoma International Airport*, August 2, 1995. In addition, the reliability of the noise monitoring data has been considered at length in the Panel's public hearings, including substantial presentations by the POS monitoring system staff. The POS relies on these three documents and the hearings to establish the reliability of the data showing the levels of noise on the ground.

The data produced by the monitoring system is reliable for purposes of this proceeding because:

- the monitors are standard industry devices that conform with national standards for noise monitoring equipment and are commonly used for aircraft noise measurement;

[3] This section responds to the first question in the Panel's September 19, 1995 Notice of Hearing on Phase II Noise Issues, p. 1.

- the devices have been periodically calibrated in accordance with standard methods;

- standard statistical methods will be used to analyze the data and present it to the Panel;

- the monitoring data is consistent with, and confirmed by, other methods of determining noise levels at the same locations which do not depend on the monitoring data or can be determined through other measurement means.

The data from the monitoring sites is the only measured data available. It is imperfect in some respects. Calibration records for the permanent monitors, for example, are not available for certain periods. Past imperfections, which have previously been explained to the Panel, cannot be rectified. However, the monitoring data is closely confirmed by the Integrated Noise Model analysis, and no basis exists for concluding that the monitors — either permanent or temporary — do not provide an accurate, overall picture of noise conditions at the Airport.

The Panel's order also required the POS to reconstruct historical noise information where none exists. While the Panel itself recognized the difficulty of this task, the POS has selected a reliable and proven method of back calculating the data using actual noise measurements as described in the POS July, 1995 submittal.

These technical questions are extensively reviewed in the three documents cited above and in the hearing transcripts.

C. "Meaningful Reduction" in Noise Impacts Should be Measured in Terms of the Number of People Who Have Benefited from Noise Reduction[4]

The number of people who have benefited from noise reductions should be the basic unit of measurement for purposes of determining satisfaction of the PSRC Resolution. The Panel has indicated clearly that the word "impacts" contained within the resolution should be assessed according to their effects on surrounding communities. The POS believes such impacts are the appropriate units of measure for satisfying the Panel's use of the term meaningful.

The Panel has made clear that its focus is on people, not raw noise impact numbers. It wants a showing that noise impacts have been reduced "in a way that residents of the affected communities could appreciate." (Order, p. 1) Dr. Fidell argued that noise numbers are meaningless unless translated into "effects of noise on people." (Transcript, p. 75) In its own brochure describing its noise reduction programs, the POS also has framed its purpose in terms of impacts on people:

> The Port . . . has long acknowledged its responsibility to be a good neighbor and to provide relief for those living with the effects of aircraft noise.

The POS will present considerable noise data, including DNL, SEL and time above data. It will present data with respect to sound insulation of homes and schools. For purposes of demonstrating "meaningful reductions" in noise impacts, all of this data will be translated into numbers of people affected. The POS submittal will rely on data with respect to benefits to people.

---

[4] This section, and the ones that follow, among other things, responds to the second and third questions in the Panel's September 19, 1995 Notice of Hearing on Phase II Noise issues, p. 2.

D. Noise Reduction Benefits to Several Thousand People Are Meaningful, and Satisfy the PSRC Resolution

"Meaningful reduction" is not a precise standard. Any particular number which purports to be the threshold of significance for this standard is necessarily arbitrary. This standard, which does not appear in the PSRC Resolution, or in the implementation steps under it, has been adopted by the Panel. To define this standard, the POS has consulted three kinds of information: (1) the primary research on airport noise, (2) experience at other airports, and (3) the Panel's explanations of the standard in its orders and hearings.

1. Research on Airport Noise. Appendix C contains a summary review of studies explicitly designed to measure the effects of changes in aircraft noise on annoyance. While none examined conditions comparable to those at the Airport or to the main questions before us, the POS consulted them for any useful suggestion on defining "meaningful reduction" in the context of airport noise generally.

None of these studies suggests that the standard Schultz/Fidell analysis of airport noise is invalid for determining impacts on people of changes in noise. No study, however, addresses the question of defining the term "meaningful" or similar terms. The POS concludes that the research studies, while confirming the Schultz/Fidell approach to the question, do not translate that research into the Panel's standard.

2. Other Airports. The POS has informally reviewed experience at domestic airports and has concluded that many airports, through their Part 150 studies or otherwise, have undertaken noise mitigation programs which provide relatively modest benefits — in many cases, reductions in noise levels and associated impacts that have been considerably less than those achieved at Sea-Tac. We infer, therefore, that such

investments of money and other resources to achieve even modest noise reductions must have been construed by these other airports and the FAA as worthwhile and "meaningful." This informal canvass of airports was not a scientific survey and did not cover a large number of airports. In almost every case, the conditions might be compared to, or distinguished from, the conditions at the Airport.

The POS thinks this experience indicates that programs less ambitious than the POS program are viewed by others to be worthwhile and meaningful. But the POS also suggests that these informal findings are likely to provoke controversy that is unlikely to be resolved. Therefore, although it supports the POS view that its program produces meaningful results, it will only be relied on for anecdotal evidence.

3. The Panel's Guidance. The Panel has been helpful in confining the range in which "meaningful reductions" can be found, and making clear its expectations with respect to that range. While a specific number is neither possible nor helpful when dealing with this complex subject, an approximate location on the spectrum of noise impact reduction can be identified.

The Panel has made clear that the reduction in noise impacts must be shown by several measures.

> We don't think there is any single metric of that sort that has so much explanatory power that it ought to be used as the sole determinative measure of the question of whether noise impacts have been reduced in the way in which we believe the resolution contemplated they needed to be reduced as a condition for the construction of the runway. (Transcript, p.196)

Among the available measures for showing reductions of noise, various quantifying devices are used by airport noise professionals. They include DNL, single event, time

above and other pure noise metrics. They also include various ways for interpreting that data, including the Schultz and Fidell curves. They include measures of pure quantity, such as the numbers of homes and schools for which insulation programs have been implemented or have been made available. Although each of these measures provides a picture, or a part of a picture, of noise reduction, the Panel has correctly concluded that none is a complete picture.

Many of these measures, when presented in their usual technical format, are difficult to compare. In almost every case with the noise metrics, considerable and sometimes controversial interpretation is required. There is, in fact, no question that noise has fallen substantially, according to these metrics, but no one has determined the "meaningfulness" of a particular metric reduction, whether modest or great, apart from its effect. It is clear from the Resolution, as interpreted by the Panel, that the point of the inquiry is determining not simply whether noise has been reduced but whether impacts on people have been reduced.

This inquiry needs a common denominator by which the many measures of noise reduction can be considered together, not only by a technically prepared expert panel, but also by Airport neighbors, users and managers. That common denominator should be the number of people who have benefited from noise reductions in a way they can, or should, appreciate. The POS intends to state noise reduction accomplishments in terms of the number of people benefited on each of a large variety of measures.

The Panel should not expect that the number of people benefited will be the same for each measure. The number will vary because different measures measure different

things. The POS proposes that the requirements of the Resolution will be satisfied if the various measures show a pattern of benefit to thousands of people.

A reliable, defensible, and precise number marking the threshold of a "meaningful" number of people benefited does not exist. As the chairman of the Panel said:

> And in this particular context, it seems to me that . . . there's an irreducible amount of uncertainty which can be resolved only by the exercise of professional judgment by the panel. (Transcript, p. 194)

Attempting to resolve that uncertainty by selecting a particular number for each of the measures of benefit as the thresholds of "meaningful" is both arbitrary and artificial. It is also unnecessary. The Panel's inquiry is limited to determining whether a threshold of benefit has been crossed. It does not matter, for purposes of the Resolution, the amount by which the threshold of benefit has been exceeded. The POS believes that, although by most measures it will exceed the threshold — sometimes significantly — the Resolution will have been fulfilled in any case where the "meaningful" standard has been achieved.

The Panel's chairman has suggested that the issue is not unlike issues routinely decided by courts in which the standard is whether the behavior in question was "reasonable," taking into account the facts and circumstances of the case. (Transcript, p. 193) The difference between those common situations and this one is that the Panel appears to expect a precise numerical standard for each of a variety of noise reduction and mitigation measurements. Although the approximate locations on scales of noise reduction benefits may be suggested, precision is not an achievable goal here. The proper threshold of meaningful benefit is the place at which reasonable people, including the

policymakers who adopted the Resolution, would generally agree that the noise conditions for the Airport's neighboring communities have improved. As with any program of social improvement resulting from mitigating events, there will be a common reasonable agreement that benefits have been achieved. The POS proposes that the Panel's job is to determine that reasonable people confronted with the same information would conclude that real noise benefits have occurred.

"Meaningful" lies somewhere in the spectrum of possibilities that range from no improvement (or worse) to improvements that are acceptable to the surrounding community. The Panel has provided considerable guidance with respect to where on that spectrum of possibilities the threshold of "meaningful" reductions, as reasonably perceived by fair observers, might lie.

The Panel has taken pains to establish its standard at the threshold of significance, and the POS believes that reasonable observers, including members of the PSRC, would agree with that approach.

> [I]t is not enough only to show that there has been a measurable reduction in average sound levels as determined by the Day-Night (DNL) metric using the existing Airport Noise Monitoring System. A measurable reduction of that sort might be so small, or have such a character, that even by objective standards, it could not be expected to make a material difference on the communities that surround the Airport. . . .
>
> We do not believe that either an "unreasonable" (i.e., unreachable or infeasible) or a "meaningless" (i.e., inappreciable or trivial) reduction in noise was contemplated by the Resolution. (Order, p.2)

Later in the Order, the Panel explained:

> [T]he POS has the burden of showing that whatever reduction it has achieved by 1996 is significant and meaningful in the sense that residents of the affected communities could, or should, appreciate it. (Order, p. 5)

The Panel has also made clear that meaningful reductions in noise impact may fall far short of satisfying public demands or implementing an ideal noise reduction program.

> [T]he Resolution does not require the POS to reduce Airport noise to "acceptable" levels, whatever they may be. Rather, the Resolution only requires that the POS achieve a significant reduction in the real noise impacts. Busy jet airports, such as Sea-Tac, are inherently noisy, and it is unrealistic to expect that nearby communities would ever find the noise impacts generated by such airports to be "acceptable." (Order, p.3; see also Transcript, pp. 235-6)

Reasonable expectations of meaningful reductions are limited, as well, by feasibility.

> [W]e're going to be looking on all of these attributes to both the question of how much change was there, and also the question is how much change could there reasonably have been expected to be, taking into account certain very important constraints. (Transcript, pp. 194-5)

Nothing in the PSRC resolution or implementing documents suggests that the finding the Panel is to make is to be based on an expectation of very large reductions in noise impacts. The standard is objective and must not be based on subjective judgments or preferences of any of the parties, or members of the Panel. The Panel is an "arbitration" panel and is not authorized to impose on the POS, the users of the Airport or the region its own preferences for a noise mitigation program. Therefore, whether the standard has been met must be determinable with reference only to an objective standard measuring reduction of noise impacts.

The PSRC resolution was adopted in light of the Mediated Noise Agreement. The Panel has concluded that proof of compliance with that Agreement — and there is no real argument that compliance has not been achieved — is "not necessarily sufficient" to establish satisfaction of the Resolution's standard. However, if reasonable people would conclude that such compliance has produced meaningful benefits, the Panel should find

that the intent of the Resolution has been fulfilled. The PSRC resolution does not contemplate a more ambitious program if the program that is being implemented today produces such benefits. The possibility that measures other than those agreed to by the POS, the community, the Airport users and the FAA in the Mediated Agreement might be used should not be material to the decision, nor should it matter that the POS program might be changed by spending additional money.

Reasonable observers would agree that reductions in impacts are meaningful if the reduction in affected people is not "trivial," and is not "so small" that it makes no material difference. Put in lawyer's terms, the number of people experiencing benefits must not be "de minimis," which is generally understood to mean "very small" or "trifling." There may be wide differences of opinion as to how many people must experience reductions in noise impacts to satisfy that modest standard. The POS suggests that the standard is met if

> **reductions in noise impact are experienced by several thousand affected people as measured on any one measure of noise reduction, provided that the entire record of reductions, taken as a whole, shows a pattern of reductions.**

Several thousand people is more than one thousand people, but much less than 10,000 people.

The POS proposes that any social measure which improves the lives of several thousand people would generally be regarded as a success. Reductions of that magnitude in local crime, illiteracy, highway accidents, or almost any other social ill would be regarded as meaningful, although perhaps not satisfactory or acceptable. That is particularly true where, as here, the problem cannot be completely solved. The intrusion

of unwanted noise in the community cannot be eliminated. In that setting, even modest gains are meaningful. Gains of several thousand people are more than modest, and for that reason this is a proper standard for the Panel. A reasonable observer would conclude that a benefit to several thousand people is significant and socially useful.

This is true even if much more gain is theoretically possible. At the Airport, the gains which are being achieved are substantially the only ones that can be achieved, given the practical limitations of the situation. But even if the Panel could conceive of a more ambitious program, or a program which it would prefer to the one which the community adopted, the meaningfulness of what is being achieved is sufficiently demonstrated if several thousand people have benefited.

Members of the Panel have indicated from time to time that they have their own preferences with respect to the content, pace and possible achievements of a desirable noise mitigation program. The Panel might prefer a different or more ambitious program, but the Panel's powers are limited. (See Order, p. 7) It does not have the power to require the fastest, the most complete or the most expensive possible program. It does not have the power to require a program which would reduce the vehemence of the objections of the kind which were directed to the Panel at public meetings. The question is whether reasonable people, including the members of the PSRC, would conclude that reductions for several thousand people is sufficient to fulfill the PSRC intent.

E. Many Objective Measures Will be Used to Show That Several Thousand People Are Better Off

To apply the "thousands of people" standard, procedures for determining who has been benefited are required. The POS intends to rely on the conventional measures of benefit common in the airport industry. Those measures are:

- Reduction in Population Exposed to Higher Noise Levels (>75 DNL & >70 DNL)
- Reduction in the Number of People and Incompatible Land Uses Exposed to Noise in Excess of Federal Guidelines
- Reduction in Population Reporting to be Highly Annoyed based upon Schultz-type Annoyance Curves (FICON Curve and Fidell Sea-Tac Survey Curve)
- Reduction in Population that May Experience Sleep Disturbance
- Reduction in Population and Percent of Time with Speech/Activity Interference (indoor/outdoor and classroom)
- Reduction in Population Exposed to Indoor Noise Environments Greater than the 45 DNL Indoor Noise Standard

These reductions will be based on established, generally accepted research on the effects of aircraft noise on people. The analysis will rely only on well accepted scientific assessment techniques. Many adverse effects of noise are difficult or impossible to establish on a statistical basis; a variety of opinions exists on the amount of these effects. The POS will quantify effects of noise in terms of a measurable change in the numbers of affected people. For many of the criteria, a single number cannot be produced in a scientifically or statistically responsible way. In those cases, the POS will estimate results

in a range. The POS will rely on the methods and sources described in the accompanying document.

Because the POS program achieved very large gains in the early 1990s, changes in the last two are more modest. The POS intends to rely on changes between the 1989-90 base year and 1996, although data for at least one intermediate year will be shown as well.

The POS is aware that some people will deny any improvement in noise impacts. The POS understands that incremental changes occurring steadily over several years may not be perceived as meaningful changes even though the difference between impacts then and today may be one of substantial improvement. The POS will provide the basis for including such people in the analysis.

The various measures will provide somewhat different numbers, even when they are intended to measure the same thing. The POS will present a wide range of noise information. Some isolated measures may be somewhat inconsistent with the pattern shown by the large mass of data. Measures dependent on the number of arrivals and departures may show less improvement or even increases because the Airport has become busier in recent years and, as the Panel has recognized, controlling the number of operations is not within the power of the POS. The PSRC Resolution, nevertheless, should be considered satisfied if the strong trend of the data shows that thousands of people have benefited from noise reductions.

F. Non-quantitative Measures Confirm That Several Thousand People Are Better Off[5]

If quantitative measures show that several thousand people have benefited from reductions in noise, the PSRC Resolution has been satisfied. Many other measures of performance will be relied on by the POS to confirm, and put into context, the consistent pattern of improvement in noise impacts for people.

1. The Noise Programs Involved the Public to Help Define What Noise Reductions Would be Meaningful to the Public. Extensive public participation in design of the POS noise program helped identify what the affected people considered to be meaningful. The public played an active role in the Mediated Noise Agreement. To the extent that the programs have been implemented as promised, the results are meaningful because they reflect what the public said was important when the programs were designed.

The mediation project combined technical and legal expertise with continuing active participation by representatives of the affected population. The Mediated Noise Agreement did not include all of the measures which the public requested. But it included many of them, including those that targeted people's major concerns, such as nighttime noise and unrestricted growth of noise. Those requests are embodied in the phase out of stage 2 aircraft at night, and in the noise budget which capped noise and provided for future reductions. Those measures have been implemented. The POS will

[5] This section responds, in part, to the second question in the Panel's September 19, 1995 Notice of Hearing on Phase II Noise Issues, p. 1.

rely on evidence, including what the public has said, that those programs and the resulting reductions in impact are appreciated.

2. The Noise Program Uses All Reasonable Measures Available at this Airport. The achievements of the POS program, however they may be measured, result from a broad-scale program with multiple elements. It takes advantage of all of the noise mitigation measures which this Airport can reasonably use. The Panel has indicated that feasibility is a consideration.

> [W]e're going to be looking on all of these attributes to both the question of how much change was there, and also the question is how much change could there reasonably have been expected to be, taking into account certain very important constraints. (Transcript, pp. 194-5)

The possibility of greater achievements is tangential to the question of actual changes in noise impacts. If the PSRC intent has been met, the Panel should not withhold its approval on the ground that it considers even greater achievements possible.

The POS will show that its program is the most ambitious program reasonably available at this Airport, that this program is very ambitious by the standards of the airport industry generally, and that additional noise mitigation measures will achieve benefits that are small when compared to what has been achieved and is scheduled to be achieved by the existing program. The Airport's noise program has been careful to make sure that benefits for some people are not achieved at the cost of imposing new noise on others. The POS continues to believe that such trade-offs are unacceptable.

The POS programs have been expensive. Since 1990, $67 million has been spent on noise mitigation. The POS's current capital budget for noise programs is estimated at $27 million per year over the next five years -- about $135 million. For 1995,

approximately 36% of the Airport's capital program is allocated for the noise remedy program, making it the Airport's single largest capital project for 1995. The POS also has been among the most successful airports in the country in obtaining federal noise funds. For 1995, the Airport has the second largest allocation of such funds among all airports. There is little reason to think that this large commitment of money can be expanded significantly.

The Airport's program is among the most ambitious in the country, as the Panel has recognized. (see p. 1) It is one of only three airports with an effective noise budget, a program which is regarded as so restrictive that it is specifically listed in the Airport Noise and Capacity Act as requiring FAA approval. The Airport is one of a very few airports that has a Stage 2 nighttime curfew. It is one of only two airports with a stage 2 curfew **and** a noise budget. The Airport also has one of the highest Stage 3 percentages among major airports.

Although the Port may not have taken every noise abatement and mitigation action possible (other strategies always exist), it has developed a coordinated and comprehensive package of feasible strategies that target the major causes of noise, annoyance and other intrusions on residents, without shifting impacts onto others.

A final consideration is that Sea-Tac Airport operates within a larger national system that exerts great pressure for travel and shipment of goods and services. Certain courses of action are simply not available to the Airport, including limiting the number of operations or controlling airline routes, rates and schedules. If an airport has done all it reasonably can do to develop and implement programs to address noise issues, these achievements should been seen as meaningful apart from other considerations.

Conclusion

The POS respectfully suggests that noise impacts must be measured in terms of people, and that if several thousand people have benefited from the POS noise reduction program, the PSRC Resolution has been satisfied. The POS further suggests that this analysis should be performed in the conventional way based on research and interpretation commonly used in the airport industry. [6]

[6] The attached document explains the data presentation and analysis procedures which the POS intends to follow. In response to the Panel's direction that the POS specify in this document all of the materials on which it intends to rely in making that presentation, the POS specifies all of those material contained in, and referred to in, the attached document. Some authors of these documents may discuss their findings with the Panel. A list of these references is attached to this Statement of Position.

References

EPA (Environmental Protection Agency). (1974). *Information on Levels of Environmental Noise Requiste to Protect Public Health and Wealfare with an Adequate Margin of Safety*, March 1994.

FICON (Federal Interagency Committee on Noise). (1992). *Federal Agency Review of Selected Airport Noise Analysis Issues.* August, 1992.

Fidell, S., Silvati, L. and Pearsons, K. (1995). *Social survey of community response to noise exposure near Seattle-Tacoma International Airport.* Bolt Beranek and Newman Technical Report Number 8070, BBN Systems and Technologies, Canoga Park, CA, USA.

Fidell, S., Pearsons, K., Howe, R., Tabachnik, B., Silvati, L. and Barber, D.S. (1994). Noise-induced sleep disturbance in residential settings. *Final Report to the Air Force Materiel Command.* Wright-Patterson Air Force Base, Ohio, USA.

Fidell, S., Schultz, T.J., & Green, D.M. (1988). A theoretical interpretation of the prevalence rate of noise-induced annoyance in residential populations. *Journal of the Acoustical Society of America, 84*, 2109-2113.

Fields, J.M. (1993). Effect of personal and situational variables on noise annoyance in residential areas. *Journal of the Acoustical Society of America, 93*, 2753-2763.

Fields, J.M. (1992). Effect of personal and situational variables on noise annoyance: With special reference to implications for en route noise. Report to NASA Langley Research Center and FAA.

Finegold, L.S., Harris, C.S., & Von Gierke, H.E. (1992). Applied acoustical report: Criteria for assessment of noise impacts on people. Cited in FICON, 1992.

Green, D.M. & Fidell, S. (1991). Variability in the criterion for reporting annoyance in community noise surveys. *Journal of the Acoustical Society of America, 89*, 234-243.

Job, R.F.S. (1988). Community response to noise: A review of factors influencing the relationship between noise exposure and reaction. *Journal of the Acoustical Society of America, 83*, 991-1001.

Miller, N.P., Von Gierke H.E., Eldred, K., "Impact Assessment Guidelines for the Effects of Noise on People", *Prepared for Transport Canada*, HMMH, Report # 291060.01, March 1991.

Ollerhead, J.B., Jones, C.J., Cadoux, R.E., Woodley, A., Atkinson, B.J., Horne, J.A., Pankhurst, F., Reyner, L., Hume, K.I., Van, F., Watson, A., Diamond, I.D., Egger, P., Holmes, D., & McKean, J. (1992). *Report of a Field Study of Aircraft Noise and Sleep Disturbance.* Department of Transport, Civil Aviation Authority, Great Britain.

Schultz, T.J. (1978). Synthesis of social surveys on noise annoyance. *Journal of the Acoustical Society of America, 64*, 377-405.

Port of Seattle

November 6, 1995

Mr. Scott P. Lewis, Ms. Martha J. Langelan
and Dr. William Bowlby
Expert Arbitration Panel on Noise and Demand/System Management
c/o Mr. Jerry Dinndorf
Puget Sound Regional Council
1011 Western Avenue, Suite 500
Seattle, Washington, 98104-1035

Dear Panel Members:

This transmits the Port of Seattle's rebuttal comments in response to statements by various parties relating to the Port's October 16th Statement of Position and supporting document. We appreciate the opportunity for response that you have provided to the Port.

Sincerely,

Gina Marie Lindsey
Managing Director, Aviation Division

Attachment

Seattle-Tacoma
International Airport
P.O. Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

PORT OF SEATTLE REBUTTAL STATEMENT

REGARDING COMMENTS ON NOISE REDUCTION STANDARD

The Executive Board of the Puget Sound Regional Council directed the Expert Panel that it is to decide whether noise has improved "using the 1989-1990 period as the noise baseline."[1] The Airport Communities Coalition (ACC) agrees that:

> Noise energy on the ground has been substantially reduced since 1990. (ACC Statement of Position, p. 3)

> The POS program achieved very large gains in the early 1990s. (ACC p. 4)[2]

> There can be no argument that, since 1990, the noise environment in the vicinity of Sea-Tac has improved. (ACC p. 16)

The ACC, echoing the Panel's finding that the Port of Seattle has been a national leader on noise, also agrees that the Port "has a relatively progressive noise program and that it has spent considerable energy on its noise programs." (ACC pp. 12-13)

The Panel has said it is looking for assurance that noise impacts have continued to improve since 1993. The Port agrees that a marked reversal after 1993 of the positive trend that began in the early 1990s would undercut the progress that the data show. But while the ACC thinks the gains since 1993 have been "modest," it agrees noise reductions have continued since 1993 nonetheless. (ACC p. 4)

That should be the end of it. A reasonable observer of this proceeding, including the members of the Puget Sound Regional Council (and its Executive Board, which is charged with

---

[1] Letter to Scott Lewis from Doug Sutherland, President of the Puget Sound Regional Council, dated April 27, 1995 (attached as Exhibit A).

[2] We assume the ACC accepts a reduction smaller than its proposed 4.5 DNL as meaningful, having agreed that the reduction in the early 1990s, which was smaller than 4.5 DNL, was very large. The ACC's proposed noise reduction standard, in any case, cannot be achieved in the stated time frame unless Sea-Tac cuts its operations.

implementing the Resolution) would agree that the requirements of the PSRC Resolution have been satisfied.

The ACC, recognizing the Port's suggestion that the proper measure of success is beneficial impact for several thousand people, says "there can be no dispute that improving thousands of lives is a creditable goal..." (ACC p. 4). The ACC, while quarreling with exactly how many thousands of people are enough, suggests that thousands of people, in fact, have not benefited. To reach that conclusion, however, it urges this Panel to do two surprising things: (1) rely solely on the DNL metric within the 65 DNL contour, ignoring other reliable widely-used research on the effects of noise on people's lives, and (2) rely on a new evaluation method especially crafted for this proceeding to the exclusion of well established methods that have the benefit of precedent and supportive published research.[3]

Both the ACC and the RCAA complain that the improvement in noise, which everyone agrees has occurred, is not the product of the Port's efforts. This is not true -- both the ACC and the RCAA know that -- but even if it were, there is nothing in the PSRC's Resolution that allows the Panel to disregard *any* improvements in noise impacts. It is a novel idea, introduced now to diminish the importance of the considerable benefits that plainly have occurred.

The Port believes that the correct standard is whether several thousand people have benefited from less noise. The Port proposes to show such benefits by relying on the well-established Schultz-Fidell curves, which show that, as portions of the population experience lower DNL levels, they are less annoyed (not *no longer annoyed,* but most certainly, according to that research, less annoyed). That research will be used, as it is routinely used, to contrast conditions in different years. The Port also will rely on well-established research showing that several thousand people have less interference with their sleep and less interference with their

[3] In contrast to the ACC, the Regional Commission on Airport Affairs agrees with the Port and the Panel that no single metric can answer the question. (See 5/5/95 Transcript, p. 196; 1/9/95 Order, p.3.)

speech. And finally, the Port will also rely on its home soundproofing program, which was accelerated in 1993, its school soundproofing program and its extensive public involvement program, which was praised by both the ACC (ACC p. 15) and the RCAA (RCAA Statement of Position, p. 7, Attachment 1).

ESTABLISHED METHODS SHOULD BE USED TO ASSESS "MEANINGFUL"

The Port believes that the Panel should use the established methodology for measuring annoyance arising from aircraft noise. This methodology has evolved over many years from the original work by researchers, including Schultz (Schultz, 1978), updated by Fidell et al (Fidell, Barber, Schultz 1991) and reaffirmed by a joint committee of governmental agencies that are involved in airport noise issues (FICON 1992). This methodology has been developed from a long process of research, peer review, industry and community scrutiny, and government agency acceptance. It is the basis for environmental decisions and Part 150 Noise Compatibility planning.

A properly performed local survey of annoyance can supplement the standard Schultz/Fidell curves. As stated in the Port's October submittal, the results of the annoyance survey by Fidell et al (1995) can be used to characterize current levels of annoyance around Sea-Tac. The results of that survey showed that a Schultz/Fidell type curve at Sea-Tac reliably correlates annoyance and DNL noise levels at the Airport.

But there are no corresponding data at Sea-Tac Airport for any prior year, and so there is no reliable and proven way to compare the 1995 data with results of a similar local survey for 1993, 1989 or any other past year. In the absence of an historical comparative survey at the Airport, the Schultz/Fidell curve provides the only proven and reliable method for comparing changes in annoyance between 1995 and prior years. In assessing the effect of change in noise

on annoyance, Fields (Fields, 1992) notes that "The balance of the evidence does not reject the assumption that changes in noise annoyance closely follow changes in noise levels."

The Schultz/Fidell curves show that, as a population experiences lower DNL noise levels, the number of people "highly annoyed" also declines. When the value of noise abatement measures is evaluated, their benefits are determined based on this type of comparative analysis. As the DNL noise level is reduced, the population will benefit. These curves show that, with a given level of reductions in noise, several thousand people can be expected to shift from the category of "highly annoyed" to a lesser annoyance category. Such changes in noise impact are meaningful both in terms of magnitude of improvement and number of people benefited.

Ideally, it would have been good to have had local information on past levels of annoyance that could be used to compare against the current levels. But such data does not exist for Sea-Tac, nor is it possible to get such data. Therefore, some other means of estimating the past levels of annoyance are needed. The ACC has proposed that this can be determined by asking residents to describe how they believe their annoyance has changed. In this method, people are required to recall with some precision how they felt about noise at a specific time in the past. They must distinguish their recollections of how they felt, for example, in 1993, as opposed to 1992 or 1991 or 1994, and compare those precise recollections with how they feel today. But the ACC provides no basis for thinking that this exacting task of memory can be performed reliably. Unlike the Schultz/Fidell curves, for which there is a long history of use, review and refinement, the ACC has not supplied the Panel with a similar foundation for the use of this technique, or for its reliance on the precision of people's memories

There are concerns with the value of the ACC approach. Research has established that people cannot recall earlier attitudes accurately and also often are unaware of changes in attitudes, even when these changes are very recent. (e.g., Bem, & McConnell 1970; Goethals & Reckman 1973; Neisser 1982). The Port does not suggest that people cannot report their

annoyance in a meaningful way when asked to do so. It is well-established that people's responses to the standard annoyance survey questions can be meaningfully interpreted. The problem with the ACC survey results on changes in noise and annoyance is not that people cannot report on their annoyance, but that the survey depends entirely on memories of annoyance over years, and that research-based techniques for determining the reliability of those memories or the usefulness of the questions that the survey used to elicit them, have not been supplied.

The criticism of the Port's proposed standard ignores the many evaluation criteria designed to illustrate that impacts from noise have been reduced and that the reductions are meaningful. Neither the ACC nor the RCAA explain why it isn't meaningful if thousands of people who were highly annoyed are no longer highly annoyed, or if thousands of people who were potentially awakened are no longer awakened. The Port's proposed methodology is valid and fair. It is based on established and standardized research that is the basis for evaluating the impacts of noise. It is not a single number evaluation but uses many metrics and many methods of evaluating how these reductions in noise may affect people. Nor does it address only populations in the higher noise zones such as the 65 DNL contour, but also in areas well beyond that boundary. It provides a clear means of illustrating to the Panel that as noise goes down, the impacts of noise (annoyance, speech, sleep and activity interference) also go down and that several thousands of people have benefited.

SEA-TAC AIRPORT NOISE PROGRAMS WORK

Because of its noise programs, not the National Noise Policy, Sea-Tac Airport is years ahead of other airports. There is no national legislation that requires nighttime stage 2 phase-out or annual noise reductions. Nor is there a national policy that requires airlines to schedule more stage 3 operations here than elsewhere. Yet the most recent statistics show that in 1994, 92% of Northwest Airline's operations at Sea-Tac were stage 3. Its total fleet was 43% stage 3. United,

one of Sea-Tac's and the nation's largest carriers, operated at 93% stage 3 at Sea-Tac with a 69% stage 3 mix for its entire fleet. America West at Sea-Tac was 99% stage 3 with a 72% stage 3 fleet mix nationally. Continental at Sea-Tac was 100% stage 3 with a 62% stage 3 fleet. Federal Express at Sea-Tac was 89% stage 3 with a 54% stage 3 fleet. Southwest had a 99% stage 3 at Sea-Tac with a 75% stage 3 fleet. These results are due to the Port's aggressive noise abatement programs implemented at Sea-Tac through the Port's efforts, including the mediated noise agreement.

SEA-TAC CONTINUALLY DOES MORE

Sea-Tac Airport over the last few years has done more than implement its progressive noise program. There have been many new initiatives since 1993. Examples include: implementation of new public buildings and multi-family insulation pilot programs; implementation of the insulation program for Highline Community College; development of procedures for local communities to access FAA planning funds; development of proposals to the Highline School District for insulation and for a long-term mitigation plan; facilitation and noise analysis for flight track changes requested by the cities of Tacoma and Federal Way; provision of technical assistance to FAA and airline committee in development of Flight Management System flight procedures to narrow flight corridors; completion of a study of the accuracy of the flight tracking system; development with Sea-Tac of a policy for assisting eligible homeowners to move their mobile homes; implementation of a program to monitor all flights on the initial flight corridors with immediate response to airline chief pilots on performance problems; initiation of a Planners Forum to better communicate with area planners on issues of importance; implementation of improvements to nighttime run-up monitoring; collaboration with FAA to correct "bow" in the northflow initial departure procedure; implementation of major changes to the residential insulation program administration to allow for tripling of insulation rate;

implementation of noise monitoring program as per the Expert Panel and completion of studies at their request; implementation of improvements to public access and information activities.

In addition to taking on new noise reduction projects and in handling day-to-day activities and interactions with numerous homeowners, community groups, FAA, pilots, airline administration, and others, the Port has achieved major goals within the programs themselves. For example, the nighttime restriction hours have been expanded as planned, the rate of insulation has tripled, the acquisition program has been completed, and the ANEL was reduced as required.

For the near future, a new Part 150 Update will begin in 1996, including development of specifications for a new noise monitoring system and consideration of additional noise abatement measures.

CONCLUSION

The intent of the PSRC resolution is met if reductions in noise impacts are experienced by several thousand affected people as measured on any one measure of noise reduction, provided that the entire record of reductions, taken as a whole, shows a pattern of reductions. The Port believes this is the correct standard. The Expert Panel does not need to rely on new research crafted just for this proceeding for evidence that benefits from noise reduction have, in fact, occurred. Rather, the Panel and the Port should rely on the available, well-established research, including the Schultz-Fidell curves. This research can be used at Sea-Tac, as it has been used at many locations worldwide, to establish that a given noise reduction produces benefits for several thousand airport neighbors.

REFERENCES

Bem, D.J. & McConnell, H.K. (1970) Testing the self-perception explanation of dissonance phenomena: On the salience of premanipulation attitudes. Journal of Personality and Social Psychology, 14, 23-31.

FICON (Federal Interagency Committee on Noise). (1992). *Federal Agency Review of Selected Airport Noise Analysis Issues.* August, 1992.

Fidell, S., Silvati, L. and Pearsons, K. (1995). *Social survey of community response to noise exposure near Seattle-Tacoma International Airport.* Bolt Beranek and Newman Technical Report Number 8070, BBN Systems and Technologies, Canoga Park, CA, USA.

Fidell, S., Barber, D.S. and Schultz: 1991. *Updating a Dosage-effect Relationship for the Prevalence of Annoyance due to Genral Transportation Noise.* J Acoust. Soc. Am., Vol. 89, pp. 221-233.

Fields, J.M. (1992). Effect of personal and situational variables on noise annoyance: With special reference to implications for en route noise. Report to NASA Langley Research Center and FAA.

Goethals, G.R. & Reckman, R.F. (1973) The perception of consistency in attitudes. Journal of Experimental Social Psychology, 9, 491-501.

Neisser, U. (Ed.& Comm.) (1982). Memory Observed: Remembering in Natural Contexts. San Francisco: Freeman.

Schultz, T.J. (1978). Synthesis of social surveys on noise annoyance. *Journal of the Acoustical Society of America, 64,* 377-405.

EXHIBIT A

Puget Sound Regional Council
PSRC

April 27, 1995

Mr. Scott Lewis, Chair
Expert Arbitration Panel on Demand/System Management
and Noise Reduction at Sea-Tac
Palmer & Dodge
One Beacon Street
Boston, Massachusetts 02108

Dear Mr. Lewis:

This letter is in response to your letter of March 15, 1995.

The Executive Board retained your panel to analyze certain noise issues at Sea-Tac. In our contract documents with the panel, we did not specifically address the base year which you were to utilize in your work. However, in our February 24, 1995 letter, we did provide you with specific, unambiguous direction on this point. You are to independently evaluate whether reductions in noise impacts required by Resolution A-93-03 have been achieved, using the 1989-90 period as the noise baseline.

We reiterate that when the Executive Board adopted the Implementation Steps resolution, we explicitly referenced the Sea-Tac Noise Budget and Nighttime Limitations Program as responsive to the noise reduction objectives of Resolution A-93-03. Appendix B-1 of the Executive Board's Implementation Steps specifically identified the time frame for the Noise Budget and Nighttime Limitation Program as between 1991 and 2001. The Noise Budget specifically identifies that the first year of noise reduction is to occur in 1991.

It is true that the panel was not retained simply to determine whether there has been compliance by the Port with the Noise Mediation Agreement. But the Executive Board's reference to the pre-existing noise program was intended to mark the starting point for analyzing whether noise reduction had occurred, and continues to occur at Sea-Tac. This reference was consistent with the Regional Council's discussion leading up to adoption of both Resolution A-93-03 and the Implementation Steps, in which the debate focused not only on whether the Port would be able to reduce noise in the future, but whether the Port's recently implemented noise reduction program was already having any reduction in "on-the-ground" noise.

It appears to us that you may be reluctant to follow our direction on this issue because your charge is, first and foremost, to be consistent with the terms of Resolution A-93-03. In this regard, we note several points.

First, there is nothing in Resolution A-93-03 which is inconsistent with our direction that you use 1989-90 as the baseline. At most, the General Assembly's resolution is silent on this issue.

Second, it was the Executive Board which drafted the resolution which ultimately was adopted by the General Assembly as Resolution A-93-03. In legislative parlance, the Executive Board acted as the committee which drafted the bill ultimately adopted by the legislative body as a whole. In this respect, the construction of the resolution by the Executive Board has heightened significance. It was the Executive Board which debated in detail the language in the proposed resolution, and ultimately crafted the specific wording of what became Resolution A-93-03. Not a single word in the resolution as drafted by the Executive Board was changed by the General Assembly.

Third, the Executive Board is specifically identified in Resolution A-93-03 as the sole and exclusive authority to implement the resolution. Unless the Executive Board's direction regarding implementation was in direct conflict with explicit language in the General Assembly's resolution, your adherence to the Executive Board's direction is mandated by the delegation language of the resolution.

Fourth, you may not be aware that the Regional Council's Interlocal Agreement, which gave rise to the organization, and the adopted Bylaws, specifically identify the Executive Board as having the authority to implement General Assembly resolutions.

We have conferred with our legal counsel who shares our opinion that we are correctly construing our documents and our implementation authority. He concurs that while your panel must be allowed to operate independently, that independence must be confined to the scope of work described by the Executive Board, consistent with the delegation to the Executive Board by the General Assembly.

In order to avoid any uncertainty at the time of your forthcoming hearings in Seattle, we request that you provide us with a clear confirmation that you will utilize the 1989-90 period as the baseline no later than May 3, 1995.

Sincerely,

Doug Sutherland, President
Puget Sound Regional Council
Executive, Pierce County

cc: Puget Sound Regional Council Executive Board

PORT 0003271

CHAPTER 1

INTRODUCTION

In April, 1993, the Puget Sound Regional Council (PSRC) approved the inclusion of a third runway at Sea-Tac in its Regional Airport System Plan, conditioned on several findings. One of those findings, the subject of this paper, must be a showing by the Port of Seattle that "noise reduction performance objectives are scheduled, pursued and achieved based on independent evaluation, and based on the measurement of real noise impacts." (PSRC Resolution A-93-03). The Expert Arbitration Panel, selected to provide the independent evaluation, has determined that that the Port of Seattle must offer evidence that it has achieved a measurable, meaningful reduction in noise impacts in the affected communities. The purpose of this paper is to provide the Port's proposal for what standard should be used in deciding if, in fact, it has been successful in meeting the PSRC intent.

Sea-Tac International Airport is recognized by the Panel and others as a leader in airport noise abatement and mitigation programs. Yet the question that still must be answered is whether, while leading the nation on this difficult issue, the Port has done enough to meet the PSRC intent. Sea-Tac's approach to noise management is comprehensive, including major noise reduction strategies that are recognized for their effectiveness in reducing noise and its associated impacts. The combination of noise abatement and noise mitigation measures has resulted in the fact that noise energy as measured on the ground has been substantially reduced for Airport neighbors since 1990. The Port will show that this has happened. People have been moved out of high noise areas to quieter areas, thousands of homes have been sound insulated, overall noise levels from the jets themselves have been reduced and many of the associated impacts have been decreased. The Port proposes that a reduction of noise impacts for at least several thousand people will satisfy the PSRC resolution.

Since 1974, the Port of Seattle has had a program to mitigate the noise effects on people living around the Airport. The Sea-Tac Communities Plan, adopted in 1976, began the process of providing local communities the avenue to actively participate in the planning process for noise issues. The policy of active citizen participation was the cornerstone of the Noise Mediation Process in 1990 and continues today. Throughout its process to develop noise reduction programs, the Port has actively engaged the public in defining what would be meaningful to them.

The following chapters and appendices are documentation in support of the Port of Seattle's Statement of Position Paper. As such, it provides a detailed explanation of the Port's noise mitigation and abatement programs, offers the Port's method of evaluating the reduction of noise impacts, and provides a standard for judging if the reduction of impacts has been meaningful.

Position on Methodology for Defining Meaningful Noise Impact Reductions

Prepared in Response to Phase II Noise Issues

October 16, 1995

Prepared for:

Puget Sound Regional Council
Expert Arbitration Panel

Prepared By:

Port of Seattle
Seattle-Tacoma International Airport
P.O. Box 68727
Seattle, Washington 98168

and

Mestre Greve Associates
280 Newport Center Drive, Suite 230
Newport Beach, CA 92660

Table of Contents

Tables **Page**

Exhibits **Page**

CHAPTER 2

THE PORT OF SEATTLE'S AIRPORT NOISE MITIGATION AND ABATEMENT PROGRAMS

2.0 Introduction

Sea-Tac International Airport is recognized as being a leader in airport noise management programs. It takes a comprehensive approach to addressing airport noise problems through both mitigation and abatement measures. In its Noise Remedy Program, nearly 10,000 homes are eligible for sound insulation to reduce noise within the home to levels that make it possible to carry on normal indoor activity such as conversations, watching TV and sleeping. The average cost of insulating an airport area home ranges from $10,000 to $19,000, and does not require any out-of-pocket costs to the owner. (State law and Port policy requires the homeowner to sign an avigation easement, limiting the Port's liability for noise damages.) Residents in high noise areas may also take advantage of the Transaction Assistance Program. Participation in this program assures homeowners they will get fair market value when they sell their home. Last year, the Port completed a $105 million acquisition program, in which approximately 1300 homes in the highest noise areas were acquired under Federal Relocation laws and residents provided with houses in quieter locations of their selection.

The Noise Remedy Office this past year initiated insulation pilot programs to acoustically insulate public use and multi-family buildings such as churches, convalescent centers, private schools and condominiums. Highline Community College is well into its $7.5 million insulation program funded by the Port of Seattle. In addition, the Port has also proposed to the Highline School District an insulation agreement and plans for developing a long-term noise mitigation strategy.

The Port's Noise Abatement Office is located at Sea-Tac Airport. The staff deals with the source of the noise -- the aircraft themselves. Airlines, through the Noise Budget and Nighttime Limitations Programs, are required to stay within prescribed noise allocations, which reduce each year and are restricted from operating Stage 2 aircraft during the nighttime hours. (10 pm to 7 am). Airlines with special permission may operate a Stage 2 aircraft during the restricted hours under very limited circumstances. At this time, there are no scheduled Stage 2 flights and approximately 2 or 3 unscheduled Stage 2 nighttime flights per week. This can be compared to about 35 scheduled flights each night before October 1, 1990 when the program went into effect. Airlines are restricted from doing engine testing (run-ups) at night unless it is an emergency or directly related to a departure. Using engine power to back-up at the gates is also prohibited. Sea-Tac Airport and the FAA over the years have developed certain noise abatement flight procedures to minimize noise over residential areas. The airport staff monitors and reports on compliance with these procedures and informs pilots when they stray from the initial departure

corridor. The Noise Abatement staff maintains the 11 station permanent noise monitoring system as well as the Airport Noise and Operations Monitoring System (ANOMS). The ANOMS system is used to investigate noise complaints and monitor the noise abatement programs. The Noise Abatement Office also conducts noise studies, flight track analysis, and other projects needed to understand the noise issue and maintain eligibility for obtaining federal funds to do noise mitigation projects..

Both the Noise Remedy and Noise Abatement Offices are readily accessible to the public. The Remedy Office is located in the community in a converted (noninsulated) school. The Abatement Office is in the Airport and features a public display room that enables staff to show visitors how operations and noise are monitored and investigated. The Noise Abatement Office also maintains a noise information line and provides flight investigations and information to the public, airlines and FAA concerning noise complaints.

2.1 Noise Remedy Goals And Achievements

In 1974, the Port of Seattle embarked on a program to mitigate noise effects on people around Sea-Tac Airport. This program, which came to be referred to as the Noise Remedy Program, was modified/expanded in 1985, 1990, and 1993. Amendments were done under Federal Aviation Regulation Part 150 and the Noise Mediation Agreement. The major components of the Noise Remedy Program are the Acquisition, Insulation and Transaction Assistance programs, which were developed and modified with a great deal of community input. The program is designed to do two things; Remove people from areas most noise affected (above 75 DNL predicted Year 2000), and reduce the noise effects on people in less noisy areas (65 to 75 DNL predicted year 2000). A matter of note is that the current prediction for the year 2000, which is found in the draft EIS for the Master Plan Update, is about 5 DNL LOWER than what was predicted for the year 2000 when the boundaries of the program were established. The Port has not reduced the Noise Remedy Program boundaries to align with the new predictions but has maintained its original insulation commitment. This means that there are some homes in the 60 DNL that continue to qualify for insulation treatment, even though their eligibility for federal funding is being questioned.

Acquisition Program. The Acquisition Program was applied to those areas that were 80+ DNL in 1985 or predicted to be in the 75+ DNL contours by the year 2000. The Acquisition Program was mandatory. The occupants of this high noise area were required to participate in the program due to the designation of the area as unsuitable for residential uses. Acquisition was completed in 1993 and included the purchase of about 1300 residences and one school at a cost of approximately $105 Million. The acquisition process for single family homes was accomplished under federal relocation laws and guidelines.

Insulation Program. The sound insulation program reduces the effects of noise inside homes and is a voluntary program. It has been available to people predicted to be in the 65 to 75 DNL contour by the year 2000. There are about 10,000 single family residences in this area of which 6,500 have asked to participate in the program (as of 8/95). Of those 6,500, approximately 4,700 have been invited to begin the insulation process and the remainder will be given that opportunity in the next 1.5 years. Depending on how many people apply, our goal as articulated in Commission Resolution 3125 is to provide up to 5,000 people the opportunity for having their homes insulated by April of 1996 and to provide the remaining 5,000 people that opportunity by the year 2,000. To accomplish these goals, we have set a target of insulating at least 100 homes per month. The Port placed an application and an addressed, stamped envelope on the doorknob of all eligible households that had not applied by late 1993. The Insulation Program has a design goal of at least 5 dB reduction and an interior noise level of not greater than 45 DNL. The Port has spent about $50 million to date on insulating single family residences. The total cost of the single family residential insulation program is estimated at $120 million.

Insulation Pilot Programs. The Port Commission directed staff in Resolution 3125 to develop a plan for including public use buildings, multi-family buildings and public schools into the Port's insulation program. The Port has identified 20 churches, 5 convalescent homes, 5 private schools, and 10,000 multi-family (condominiums and apartments) homes within the Program Boundaries. Through the Part 150 process, a Pilot Project has been initiated to test the insulation process and administrative procedures for accomplishing the work for these types of structures. The Pilot Project includes 2 churches, 1 convalescent home, a private school and a condominium. The goal for the Pilot Project is completion by April of 1996. If the projects are successful (noise reduction achieved, cost within reasonable range of estimate, etc.) similar structures that are eligible for federal funding and PFCs will be included as a regular part of the Port's existing Noise Remedy Program. The FAA has some input/control as to determining the success of the Pilot Projects and the subsequent eligibility for funding. The Pilot Program cost is estimated at $3.5 million with full program costs estimated at about $50 million. This cost estimate could go up by $100 million depending on an FAA determination of eligibility for apartment buildings, the results of the pilot program, which will better define costs, and the Port Commission's direction based on the findings.

Public School Insulation. The Port has identified about 20 public schools within the Program boundaries. One school, Highline Community College, is currently being insulated using Port funds. The goal is to meet the federal criteria of obtaining 5 dB reduction and 45 DNL for all treated rooms at the cost agreement of $7.5 million.

Most other schools in the Noise Remedy Program boundaries are part of the Highline School District. Although there has been considerable discussion with the District on working together to plan and implement noise mitigation, no agreements have been reached. Since 1993, the Port has worked with District staff to develop ways of assisting the School District with noise mitigation. The Port's immediate goal was to provide insulation funding for Pacific Middle

School and Glendale Elementary. A long-range goal was the completion of a noise mitigation and funding plan jointly developed by the District and Port. The Port began discussions with the District on these goals following comments by District representatives at a public hearing on the Flight Plan Project in spring of 1992. Port staff and District staff worked together to draft two agreements for review by the district. These draft agreements -- one specific to Pacific Middle School and Glendale Elementary and one that would initiate a noise mitigation planning process -- have been included in Appendix A, along with a $1.5 million grant request for public school insulation and other documentation that shows the Port's intent and actions related to working with the Highline School District on noise mitigation.

Mobile Home Assistance. Because mobile homes cannot be insulated due to their lightweight construction, the FAA has placed a low priority on funding noise mitigation for these structures if they are outside an acquisition area. As far as we know, Sea-Tac Airport is the only airport providing assistance to mobile home residents outside acquisition areas.

The purpose of the mobile home assistance program is to provide some limited incentives to property owners to convert to more compatible land uses. It was designed to complement the city of SeaTac policies on assisting mobile home park residents if their mobile home parks were slated for closure. For this measure to be truly effective, other cities within the boundaries that have mobile home parks would need to enact similar policies. The Port will provide some funds to the park owner to distribute to residents for help in moving their mobile homes. A number of conditions must be met. First, a property owner must be planning to close the park and seeking to convert the use of the property to a more compatible use. The jurisdiction in which the park is located must require the owner to develop a relocation plan for residents. (The city of SeaTac is so far the only jurisdiction that has that requirement.) It is anticipated that availability of some funding for moving the mobile homes would be a significant factor in the relocation plan. The owner must stipulate that no noncompatible uses will be allowed back on the property and that money from the Port will be available to the homeowner for moving his/her mobile home. Finally, a jurisdiction must agree to restrict development on the property to noise compatible uses. There have been no applicants for the mobile home assistance program and we, therefore, have had no experience with the implementation. It is likely that modifications to the program will occur as the procedures are put to use. There is no specific goal associated with this program. The cost is estimated at $3 million over the next four or five years.

Transaction Assistance Program. The concept of "neighborhood reinforcement" was built into the Noise Remedy Program for areas in the 70 to 75 DNL. In fact, this area was originally called the Neighborhood Reinforcement Program area because its goal was to provide active support of the residential character of the neighborhoods by not only providing sound insulation but also assurances that should residents decide to move, they can get fair market value for their homes. This method is called Transaction Assistance. It guarantees that the homeowner will receive the same amount of money for their house as they would receive had their house not been located in the high aircraft noise area. If the house does not sell through the normal real estate sales process, the Port will purchase and resell it. The program requires that a home be first insulated by the

Port. This provides the homeowner the opportunity to determine if the insulation helps him/her in deciding to move (some have decided to stay after their home has been insulated) and also ensures that the house that is sold is compatible with the noise environment. This program is available to about 3,500 residences of which 226 have applied.

Special Purchase Option. A special subcategory of the Transaction Assistance Program is the Special Purchase Option program. This program is available to homeowners that live directly next to Port property. The homeowners may decide to sell their home directly to the Port and move without waiting to go through the insulation process or to go through the normal real estate sales process. Again, the homeowner is assured fair market value for his/her home.

2.2 Noise Abatement Goals And Achievements

The Port of Seattle's comprehensive noise programs were developed from Airport and community planning efforts including the 1976 Sea-Tac Communities Plan, the 1985 Part 150 Plan (updated in 1993) and the 1990 Sea-Tac Noise Mediation Agreement. The major noise reduction programs at Sea-Tac Airport were developed through the Noise Mediation Project and include the Noise Budget and Nighttime Limitations Program which restricts the use of Stage 2 aircraft. The Noise Abatement Program also includes restrictions on engine testing, especially at night, restrictions to the use of engine power to back up at gates, monitoring and reporting on compliance with Sea-Tac noise abatement procedures, monitoring of airport noise, updates to Sea-Tac's noise exposure maps and noise compatibility program and a public access and information program, including an information and noise complaint line.

Noise Budget: This program encourages a steady progression towards an all Stage 3 fleet by limiting the amount of noise the airport is allowed to make each year. This program targets those air carriers contributing significant levels of aircraft noise and requires them to operate within an annual noise allocation. An air carrier whose noise contribution is below a level that is considered to not significantly impact the overall noise exposure level of the airport is not required to participate. Operations by government aircraft, and aircraft operating under a bi-lateral agreement with a foreign government are also not required to participate. Otherwise, all remaining carriers are provided with an annual noise allocation, which decreases each year. The Noise Budget went into effect January 1, 1991, and has a goal of achieving a 50% noise reduction by the year 2001, as set forth in the Noise Mediation Agreement. The following is the schedule of Airport Noise Exposure Level (ANEL) noise reduction agreed to:

CALENDAR YEAR	MAXIMUM ANEL	% REDUCTION
Base Period	74.53	0%
1991	74.35	4%
1992	74.17	8%
1993	73.88	14%
1994	73.59	19%
1995	73.28	25%
1996	72.97	30%
1997	72.66	35%
1998	72.31	40%
1999	71.96	45%
2000	71.60	49%
2001	71.24	53%

A main feature of the Noise Budget is the strong incentive it provides for an airline to convert as rapidly as possible to Stage 3 aircraft. If an airline meets or exceeds certain levels of Stage 3 aircraft at Sea-Tac, it may operate outside its noise allocation. In 1991, that level was set at 70% Stage 3. It has and will increase in the following manner:

1992 - 73% Stage 3
1993 - 77% Stage 3
1994 - 81% Stage 3
1995 - 85% Stage 3
1996 - 90% Stage 3
1997 and thereafter - 95% Stage 3

The Port monitors each airline participating in the budget and reports the findings to the Sea-Tac Noise Advisory Committee and in the Noise Abatement Office quarterly report, which is mailed to more than 4500 residents. Any airline that exceeds its annual allocation may be fined up to $1 million per year Currently all airlines are operating in compliance with the limits of the Noise Budget.

The Port believes this effort to encourage use of Stage 3 aircraft at Sea-Tac has been successful. The progression of Sea-Tac's Stage 3 fleet mix is an indicator of this success.

YEAR	STAGE 3 FLEET MIX
1986	41%
1987	42%
1988	43%
1989	48%
1990	53%
1991	56%
1992	64%
1993	77%
1994	82%

Nighttime Limitations Program: This program is designed to phase out the use of Stage 2 aircraft during the nighttime hours. During the program's first two years, October 1, 1990 through October 1, 1992 , no new Stage 2 flights were introduced between midnight and 6:00 a.m., and only pre-existing Stage 2 flights were allowed to continue operating during those hours. Since October 1, 1992, Stage 2 flights have been restricted during the following phased in schedule:

EFFECTIVE DATE	RESTRICTED HOURS
October 1, 1992	Midnight to 6:00 a.m.
October 1, 1993	11:00 p.m. to 6:30 a.m.
October 1, 1994	10:30 p.m. to 6:45 a.m.
October 1, 1995	10:00 p.m. to 7:00 a.m.

The number of nighttime Stage 2 flights has reduced from the scheduled 39 per night, between the hours of 10:00 p.m. - 7:00 a.m. in 1990, to the current 2 or 3 per average **week** which qualify for exemptions during these nighttime hours. Airlines may apply for variances or exemptions to operated outside the regulation, but requests are not always granted. Exemptions include weather or mechanical delays, or other unforeseen circumstances outside the control of the air carrier. Variances allow regularly scheduled Stage 2 flights to continue operating during the nighttime hours if extreme circumstances can be documented. There are currently no airlines operating under a variance. The resulting nighttime fleet mix has averaged over 98% Stage 3 from May of 1994 to April of 1995, and continuously over 99% Stage 3 since then.

This program is closely monitored. Violations to the program incur a letter of admonishment for the first non-complying operation in a quarterly period, and monetary fines for each event thereafter during the same quarter. The fines start at $500 and increase to $1000 for the next violation, and to $2000 for subsequent violations. The Aircraft Noise and Operations Management System is used to track nighttime operations on a daily basis. Any questionable operations, which may have been Stage 2 aircraft type are researched. To date, five (5) letters of

admonishment have been sent. The Nighttime Limitations Program guidelines, as set forth in the Noise Mediation Agreement, have been adopted by Sea-Tac Airport's Rules and Regulations.

Ground Noise Control:

- Powerbacks - Airlines are not allowed to use engine power to back away from gates. Instead, aircraft are pushed away from the gates by tugs.

- Run-Ups - Engine testing is a regular and unavoidable part of airport operations. Airport regulations have been established for when and where airlines may "run up" aircraft engines to check their operations at various power settings. During the daytime, run-ups are limited to certain airport locations. Between 10:00 p.m. and 7:00 a.m., they are allowed only under special circumstances and cannot exceed a 2-minute duration. If an aircraft is scheduled to depart between 7:00 a.m. and 8:30 a.m., they may run-up as needed between 6 am and 7 am. Any unauthorized run-ups are subject to penalties. Between January and June, 1995, there were 193 engine run-ups during the daytime and 18 during the restricted hours. Sea-Tac Operations staff must be completed a form whenever they receive a request for a run-up, indicating specific information and whether the run-up was denied or granted. Requiring this documentation helps ensure the 2 minute limit is enforced at night and that there is sufficient tracking of run-up activity.

Flight Track Monitoring: The Federal Aviation Administration (FAA) established flight patterns for Sea-Tac. Of the many flight patterns in the Seattle-Tacoma area, the following flight paths (or noise abatement corridors) were developed to minimize noise over residential neighborhoods. These corridors are visually depicted on the attached maps (**Exhibits 2-1** and **2-2**).

- The initial straight-out departure corridors north and south is a procedure designed to keep departing aircraft in the narrowest fight path possible to minimize population exposed to departure noise.

- The Duwamish/Elliott Bay corridor for arriving and departing aircraft calls for air traffic controllers to direct jet aircraft over water and industrial areas as much as possible, depending on controller workload and safety requirements.

- Puget Sound nighttime procedures keep departing nighttime jet flights over the waters of Puget Sound as much as possible. Aircraft heading north are directed out over Elliott Bay, then north or south over Puget Sound. They are not allowed to turn east or westbound until reaching altitudes and distances from Sea-Tac as specified in the Noise Mediation Agreement. Aircraft heading north should not be turned eastbound or westbound to recross land east or west of Puget Sound until reaching 10,000 feet MSL or the SEA 320 Radial/20 nm DME fix. With the increased use of newer aircraft which climb more efficiently, some aircraft are reaching 10,000 feet MSL before leaving the mouth of Elliott Bay. Sea-Tac Air Traffic Controllers agreed to direct aircraft out through Elliott Bay before approving an eastbound turn even at altitudes above 10,000 feet. Aircraft heading south should not be turned eastbound to recross land east of Puget Sound until after passing the SEA 220 Radial/12 nm DME fix at or above 10,000 feet MSL.

With information provided by the FAA's air traffic control radar system, the Noise Abatement Office uses the Aircraft Noise and Operations Management System (ANOMS) to monitor flights in the noise abatement corridors. The results pinpoint how successful air traffic controllers and pilots are at keeping flights within those corridors. The findings are given to the FAA, airlines, pilots and the Sea-Tac Noise Advisory Committee. When published reports of procedure success rates started being distributed, success rates for the initial departure procedure rose from the mid-80% to consistently averaging over 95% ever since.

Installation of ANOMS in June of 1993 has improved flight track monitoring and analysis at Sea-Tac. The system allows staff to investigate citizens' noise complaints or questions by providing details on each flight such as aircraft type, aircraft identification number, airline, and flight number; flight track plotting; and information used to monitor the Noise Budget and Nighttime Limitations programs.

Noise Monitoring: The Port of Seattle has an established permanent noise monitoring system that measures the DNL noise levels at eleven (11) locations within the 65 DNL noise contour area. The noise monitoring system was manufactured by EG&G and utilizes hydrophone microphones. This system was installed in 1979 with two (2) additional sites added in 1985. The system's primary function is to continuously measure daily DNL noise levels from all sources of noise. The measurement system computer program contains software that separates noise into categories of aircraft, community or total noise. The system includes daily internal calibration checks. The Port of Seattle contracts with an outside contractor to conduct field calibrations on a bi-monthly basis. Also, a more thorough system evaluation and grooming was completed in 1989 and 1993, and April and October of 1995.

Public Access and Information: Providing avenues for two-way exchange of information is an area on which the Port of Seattle has focused much time and attention. The 24-hour noise information line has for years provided an opportunity for residents to request information or report bothersome aircraft noise. Through this program, staff have talked with over 500 citizens and mailed 350 information packets in 1995 to date. Public concerns are reported to the FAA, airlines, and the Port. Public feedback collected from the information line is used to improve the noise abatement programs and to better understand specific issues that are of concern to people around the airport. The history of calls to the information line is charted below:

YEAR	TOTAL CALLS RECEIVED
1988	7,765
1989	11,005
1990	14,458
1991	10,534
1992	7,756
1993	5,049
1994	4,541

Other informational opportunities include annual open houses, attending Sea-Tac Noise Advisory Committee meetings, tours of the airport which include the noise offices demonstration of the flight track computer equipment, participating on committees formed for special projects, and monthly "Sound Off" sessions. The monthly Sound Off meetings provide an opportunity for citizens to talk one-on-one or in groups about current concerns, and ask questions about noise issues. In addition, Port staff will and often do, upon request, meet with individuals or groups on specific issues.

Port of Seattle

Seattle - Tacoma International Airport

Noise Abatement Procedures

NORTH FLOW

- INITIAL DEPARTURE
- DUWAMISH / ELLIOTT BAY DEPARTURE - NIGHT
- DUWAMISH / ELLIOTT BAY DEPARTURE - DAY
- PUGET SOUND DEPARTURE - NIGHT

Port of Seattle

Seattle - Tacoma International Airport

Noise Abatement Procedures

SOUTH FLOW

INITIAL DEPARTURE

PUGET SOUND ARRIVAL

PORT 0003289

Chapter 1

CHAPTER 3

EVALUATION METHODOLOGY FOR THE MEASUREMENT OF MEANINGFUL REDUCTIONS IN NOISE IMPACTS

3.1 Introduction

There are no current standards or guidelines available to either the public or to airports that define a meaningful reduction of noise impacts. Nonetheless, the Expert Panel has challenged the Port to develop its own definition of "meaningful" and to show that a meaningful reduction in noise impacts has been achieved. As noted by all parties, this is a difficult problem. While a case can be made that the noise reduction that has been achieved is measurable and statistically reliable -- and therefore "real" -- establishing a practical value or meaning for the reduction is an arbitrary decision. Given that we cannot completely eliminate airport noise, we must determine how much and by what measure(s) its reduction can be judged to be meaningful. Establishing practical value is a judgment call and ultimately a policy decision based on criteria that policy makers have decided are important.

We are using the term "practical value" to mean results that can be appreciated. Defining practical value or meaning depends on the value placed on the dimensions you are measuring. For example, if in trying to measure customer satisfaction, we measure the time it takes to respond to a call but response time is not an important factor for the customer, then the value we assign to our results does not have practical meaning. Dealing with meaning, then, is extremely difficult because different segments of society and even different individuals, often have frankly different values. There are no rules or procedures that define precisely what to measure so that the results will have important meaning or value to everyone. Fortunately, there are community noise impacts that are widely recognized and commonly evaluated. These include annoyance, speech and activity interference (both indoors and outdoors), and sleep disturbance. We are using measures of these impacts because they are recognized in research as important to the community. Demonstrating reduction of these impacts therefore demonstrates that the results of the Port's noise programs have practical value and meaning.

The Panel has instructed us to collect a variety of data and to use it in support of our position on noise impact reduction and the PSRC resolution. Because the Panel has asked us to demonstrate impact reduction that people could appreciate, the Port has chosen to examine noise reduction that has benefited people in ways that they value. Addressing these community impacts is more applicable to defining practical value than assigning meaning to a threshold decibel number. The Port of Seattle has articulated its standard of meaningful reduction in impacts in the Position Paper:

> **Reductions in noise impact are experienced by several thousand affected people as measured on any one measure of noise reduction, provided that the entire record of reductions, taken as a whole, shows a pattern of reductions.**

The Port will be looking for improvements in people's lives in terms of reductions of sleep disturbance, speech and activity interference, annoyance, classroom speech interference; reduction of in the number of residents exposed to the higher aircraft noise levels; and decrease in incompatible land uses exposed to noise levels above federal guidelines.
Within this document:

- The changes in community impacts are defined in association with the levels of noise reduction.
- The Port's proposal for specific evaluation criteria for the measurement and evaluation of reductions in noise impacts is presented.
- Information is provided to establish context for the reduction of noise impacts that has been achieved.

3.2 Evaluation Criteria

The following are the criteria the Port believes the Expert Panel should consider in evaluating whether the Port has met the intent of the PSRC Resolution.
Each of these criteria are discussed in greater detail in the next part of this chapter.

- Evaluation Criterion 1: Are the noise levels as measured by noise monitoring actually being reduced?

- Evaluation Criterion 2: Do the reductions in noise result in a coherent pattern of improvement in the noise impacts to residents surrounding Sea-Tac that result in a reduction in impacts to several thousands of people?

  - ✓ Reduction in Population Exposed to Higher Noise Levels (>75 DNL & >70 DNL)
  - ✓ Reduction in the Number of People and Incompatible Land Uses Exposed to Noise Levels in Excess of Federal Guidelines
  - ✓ Reduction in Population Annoyance based upon Schultz-type Annoyance Curves (FICON Curve and Fidell Sea-Tac Survey Curve)
  - ✓ Reduction in Population that May Experience Sleep Disturbance
  - ✓ Reduction in Population and Percent of Time with Speech/Activity Interference (indoor/outdoor and classroom)
  - ✓ Reduction in Population Exposed to indoor noise environments greater than 45 DNL

Evaluation Criterion 1
Are the noise levels as measured by noise monitoring actually being reduced?

Introduction: A concern of the PSRC is whether the reductions in noise predicted to occur based upon the Port programs actually result in reductions in noise that can be measured by noise monitoring equipment. For example, the Noise Budget is based on a mathematical formula while the Nighttime Limitations Program is a regulatory program that limits aircraft type based upon certificated noise. Do these programs that are mathematical or regulatory actually translate into reductions in noise that can be measured through noise monitoring?

There are three basic programs that can be evaluated through this evaluation criterion. These include the Noise Budget, Nighttime Limitations and Noise Insulation Programs. Each program will be evaluated with respect to the level of compliance with the program goal.

Statistical Reliability: To be meaningful and "real," a reduction in airport generated noise level must be demonstrated to be statistically reliable and measurable. This means that the observed (mean) reduction across a test period must be unlikely to have arisen from chance fluctuations by incidental variations in air traffic, weather conditions, etc. While important to the foundation of an argument for "meaningful," using statistical reliability doesn't completely address the issues of concern or meet the goals the Panel has set forth.

Because of fluctuations in the number of operations by different types of aircraft, variations in traffic patterns, varying weather conditions, and other factors, aircraft-generated DNL at each monitoring site varies from day-to-day. Given these conditions, mean daily DNL at each monitoring site will be taken to represent the central tendency of the measurements and thus to summarize the aircraft-generated noise climate at each site. To ascertain whether any change in DNL measured at a particular site has taken place, it is necessary to ascertain whether the observed difference between the mean daily DNL in the two years in question could have arisen by chance with a relatively high probability. We will provide mean daily DNL for each monitoring site for the base year and each year since then through 1995. We will test the values for each year against those for the base year by computing the t-statistic for each pair of means for each site to determine if the observed difference is statistically significant at the 95% confidence level.

Achievement of Noise Budget Noise Reduction Commitments

Summary Description: The Port of Seattle, through the Noise Mediation Agreement, has committed to specific noise reduction goals. These goals were established in 1990 and include specific target levels through the year 2001. These levels are based upon a mathematical formula and the PSRC is concerned that this formula can be translated into actual reductions in noise that can be demonstrated through noise monitoring. As a result, an important measure for achievement of meaningful reduction in noise impacts is to show that at the midpoint of the program, 1996, the commitments of the Port concerning the overall noise levels are actually being achieved, and that they do result in measurable reduction in on-the-ground noise levels.

Evaluation Methodology: The Noise Budget within the Noise Mediation Agreement includes a key provision committing the airport to achieve certain reductions in noise over a ten year period. The Noise Budget limits are in terms of the descriptor ANEL (Airport Noise Equivalent Level), which was designed to be similar to DNL. The noise data determined from this study will be used to demonstrate that the Noise Budget limits are being achieved and that these limits result in corresponding reductions in measured DNL noise levels. The methodology to be used presenting this data was outlined in Noise Validation Methodology presented in July 1994 and in the May 1995 report on the Revised Noise Validation Methodology.

The results of the noise measurement survey will provide annual aircraft DNL noise level information at each of the permanent noise monitoring locations as well as at the six new supplemental noise monitoring locations. An example of how this data will be presented is shown in Table 3-1.

Table 3-1
Example for Annual Aircraft DNL Noise Levels

Site	Base Period	1993	1995/96	2001
1	71.5			
2	71.4			
3	74.2			
4	83.2			
5	70.3			
6	81.3			
7	74.3			
8	70.9			
9	70.7			
10	72.8			
11	76.3			
N1	--			
N2	--			
N3	--			
S1	--			
S2	--			
S3	--			
Arithmetic Average	--			
Noise Reduction	--			

Achievement of Nighttime Noise Reduction Benefits Associated with Nighttime Limitations Program

Summary Description: The Noise Mediation Agreement included a provision that restricted the operations of Stage II aircraft during the nighttime hours. As a result, an important goal for achieving meaningful reduction in noise impacts is to show that the commitments of the Port to limit nighttime operations actually resulted in measurable reduction in nighttime single event noise levels.

Evaluation Methodology: The effect of this operational limit on nighttime noise will be demonstrated using the acoustic data derived from the monitoring program. Acoustic data regarding the change in noise levels will include: (1) energy average SEL noise level for nighttime events and, (2) distribution of SEL events. The primary purpose of the Nighttime Limitations program was to reduce the potential for sleep disturbance. The effect of these changes in noise relative to the potential for sleep disturbance is described in Evaluation Criterion 2, Measure D.

The program is designed to eliminate the loudest of aircraft from operating during the nighttime hours. Thus, the results should be evaluated by examining the shift of events from the higher noise values to the lower values. The program is achieving the intended results if the data shows a reduction in the number of higher noise level events.

Achievement of Noise Reduction Benefits Associated with the Single-Family Residential Insulation Program

Summary Description: The single-family insulation program has a goal of insulating 100 homes per month. The design goal of the program is to reduce noise within the home to the point where normal indoor activities can occur without undue disruption from aircraft noise. The program has two objectives. The primary objective is that the interior noise levels be reduced to 45 DNL or below, which is the recommended level to avoid activity interference. The secondary objective is that the building noise reduction is increased by at least 5 dBA over pre-insulation conditions.

Evaluation Methodology: The Port believes that the Panel should evaluate the data to determine if the Port is reasonably meeting its design goals. The Port will present a compilation of the data from actual field tests that shows the level of achievement with respect to the program objectives.

Evaluation Criterion 2

Do these reductions in noise result in a coherent pattern of improvement in the noise impacts to residents surrounding Sea-Tac that results in reductions in impacts to several thousands of people?

Summary Description: The Panel has asked the Port to go beyond decibel metrics, such as DNL, and look at other measures that demonstrate "meaningful" through reduced community impact could be appreciated by residents. We will examine a variety of descriptors for the ways in which airport noise may affect residents. We will look both indoors and outside, look at homes and at schools, and draw together links between reduction of airport noise and improvement for people.

Evaluation Criterion 1 is designed to determine if noise levels around Sea-Tac have indeed been reduced. Evaluation Criterion 2 examines how the character of the noise changed as a result of these reductions and how that translates into reduction in noise impacts. Noise impacts are defined in terms of adverse effects to people. The results of the changes in noise will be evaluated in terms of the reduction in population that is adversely affected by aircraft noise. Changes in the following commonly described adverse effects of noise will be evaluated to determine the level of improvement that has occurred.

Community Annoyance
Speech and Activity Interference (indoor/outdoor and classroom)
Sleep Interference

Based upon these noise effects, a number of methods of measuring the reduction in noise impacts has been developed. These methods are summarized below. Within this evaluation criterion, each method is presented with respect to supporting research and analysis methodology used in the development of the measure.

- ✓ Reduction in Population Exposed to Higher Noise Levels (>75 DNL & >70 DNL)
- ✓ Reduction in the Number of People and Incompatible Land Uses Exposed to Noise Levels in Excess of Federal Guidelines
- ✓ Reduction in Population Annoyance based upon Schultz-type Annoyance Curves (FICON Curve and Fidell Sea-Tac Survey Curve)
- ✓ Reduction in Population that May Experience Sleep Disturbance
- ✓ Reduction in Population and Percent of Time with Speech/Activity Interference (indoor/outdoor and classroom)
- ✓ Reduction in Population Exposed to indoor noise environments above 45 DNL

The methodology for assessing reductions in noise impacts will be based upon established research and generally accepted methods in the field of aircraft noise effects. The analysis will utilize only scientifically and government agency accepted noise effects and impact assessment methodology. The Panel should recognize that many adverse effects of noise are difficult or impossible to establish on a statistical basis and that there is a variety of opinions as to the degrees of these effects. For the purposes of this assessment, the effects will be quantified in terms of a measurable change in the number of affected people. For many of the effects, the Port cannot anticipate a single number, but will estimate the results as a range. Actual results will vary based upon distance from the Airport and will reflect the variety of research used in the analysis.

The following measures explain each of the methods proposed to evaluate reductions in noise impacts to people around Sea-Tac Airport.

Measure A. Reduction in Population Exposed to Higher Noise Levels

Description: One of the important aspects of any noise control program is the reduction in the number of people exposed to higher aircraft noise levels. Research into the effects of aircraft noise have shown that there is a greater potential for adverse effects at the higher noise exposure levels. As a result, an important goal for achieving meaningful reduction in noise impacts is to reduce the number of people who are exposed to these higher noise levels.

Supporting Information: The FAA Part 150 Land use Compatibility Guidelines (FAA Advisory Circular 150/5020-1, Noise Control and Compatibility Planning for Airports, Appendix 1, August 5, 1983) consider residential land use incompatible with exposure to noise levels in excess of 75 DNL, even with adequate noise insulation. Within this area, according to the FICON annoyance curve, %HA (Highly Annoyed) would be predicted to be about 37% and "Noise is likely to be the most important of all adverse aspects of the community environment." (FICON, 1992).

The Port believes that it is reasonable and prudent that noise abatement programs include measures that reduce the number of people exposed to noise levels in excess of 75 DNL. Addressing the impact to those with the highest noise exposure is of greatest importance to any mitigation program and represents a significant goal of the Port. The Port also believes it is meaningful to show a reduction in the number of people located within the 70 DNL noise contour. Thus, reduction in the number of people exposed to noise levels in excess of 70 DNL is also an important measure.

Analysis Methodology: The methodology for determining the population exposed to noise levels in excess of 75 and 70 DNL will be based upon a noise contour modeling analysis. The contours will be generated with the INM noise model using aircraft operations for 1989/90 (Base Period), 1993, 1995/96 (evaluation year) and the predicted year 2001. The extensive noise monitoring program now under way will also be used to validate the INM noise model. This validation process will compare the measured aircraft single event noise levels with the single event levels in the noise model. The contours will then be overlaid with population census data to determine the number of residents within each contour zone. The results will be presented as the total population within each contour zone for each of these years. An example of how this data will be presented is shown in Table 3-2.

Table 3-2
Example for Results of Population Within Noise Contour Zones

DNL Noise Contour	Population			
	Base Period	1993	1995/96	2001
Total Population				
>75 DNL				
70 - 75 DNL				
Reduction in Population				
>75 DNL	--			
70 - 75 DNL	--			

Measure B. Reduction in the Number of People and Number of Incompatible Land Uses Exposed to Noise Levels in Excess of Federal Guidelines

Description: Federal guidelines have identified 65 DNL as a threshold exterior noise level for which noise sensitive land uses such as residential land uses can be considered incompatible. As a result, the federal government developed the FAR Part 150 process to assist airports and local government agencies in developing programs and policies to reduce the number of residents exposed to noise levels above this threshold. Through the Part 150 process, airports and communities have developed acoustical insulation programs that have been judged by the FAA to be effective and eligible for federal funding. Thus, a measure of achieving meaningful reduction in noise impacts is the reduction in the number of dwelling units and residents exposed to noise levels in excess of 65 DNL and of these, the number of insulated dwelling units and their residents.

Supporting Information: The Federal Aviation Regulations FAR Part 150 contain guidelines for determining the sensitivity of specific land uses to various levels of aircraft noise (Noise Control and Compatibility Planning for Airports, Appendix 1, FAA Advisory Circular AC 150/5020-1, August 5, 1983). Exhibit 5-1 presents these Part 150 guidelines, which specify what land uses are compatible with various DNL aircraft noise levels. These Federal guidelines show that residential land uses without proper sound insulation are generally unacceptable in areas exposed to noise levels in excess of 65 DNL. With appropriate soundproofing, however, residential structures may be compatible with noise exposure levels of 65 to 75 DNL.

Analysis Methodology: Noise contours for the evaluation will be generated using the validated Integrated Noise Model (INM) as described previously for Measure A. DNL noise contours for annual operational levels for the specific study period years will be generated. Using these noise contours and land use data, the changes in the number of housing units, population and sensitive land uses within various contour levels will be determined. The source for the population estimates will be the 1990 U.S. Census. These data will be determined for the study years and summarized as in the example Table 3-3.

Table 3-3
Example of Summary of Land Use Changes

Category	Units within 65 DNL Contour			
	Base Period	1993	1995/96	2001
Total Housing Units				
Compatible (Insulated)				
Incompatible (Uninsulated)				
Total Population				
Compatible (Insulated)				
Incompatible (Uninsulated)				
Total Schools				
Schools with Insulation				
Schools w/Insulation offer				
Uninsulated Schools				
Reduction in Incompatible Land Uses				
Incompatible Residences				
Incompatible Population				
Incompatible Schools				

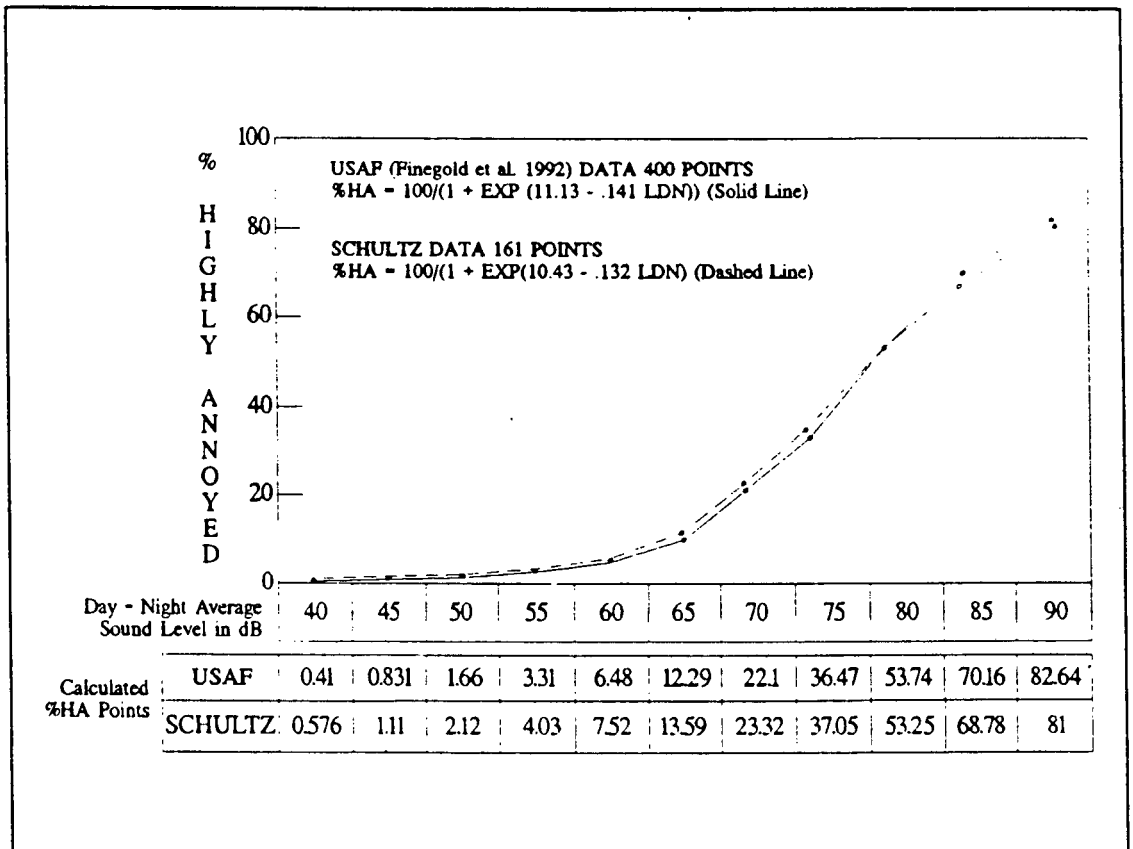
Measure C. Reduction in Population Annoyance Based Upon Schultz-Type Annoyance Curves (FICON Curve and Fidell Sea-Tac Survey Curve)

Description: Noise is often defined as "unwanted sound" and one of the common effects of noise on people is to cause annoyance. Researchers into the effects of noise have established methods that relate aircraft noise, typically expressed as metrics such as DNL, to the percent of the population that would be considered "highly annoyed" by aircraft noise. This evaluation measure uses this established methodology to measure the reduction in the number of people that would be described as "highly annoyed" by aircraft noise.

Supporting Information: Annoyance to noise is a human reaction that summarizes many of the adverse effects to be expected from exposure to aircraft noise. These effects include speech and other activity interference (use of telephone, radio, TV), sleep disturbance, and non-acoustic factors (see also Noise Impact Evaluation Criterion 2, Measure D). The FICON report states "Currently, the best available measure of this response (annoyance) is the percent of the population characterized as "highly annoyed" (HA%) by long term exposure to noise of a specified level (expressed in terms of DNL)" (FICON, 1992).

Annoyance reactions to aircraft noise can be usefully summarized in graphs of the percentage of interview respondents claiming they are highly annoyed as a function of DNL. Percent highly annoyed will be termed "%HA" and refers to the percentage of people who, when asked one of a variety of questions about their reactions to noise over a defined previous period of time (often a week or a year), respond with a category in the upper one-sixth to one-quarter of the typical scale indicated in the question (often the upper category alone when labeled as such).

FICON (1992) recommended the use of a modification of the well-known "Schultz curve" (Schultz, 1978). This FICON curve and the original Schultz curve are reproduced in Exhibit 3-1. The lines shown in this graph represent the mean responses for multiple survey groups. The responses of any one individual can vary considerably. The original curve has been updated by the addition of many new data points and the result is virtually the same as the original (Fidell, Barber, & Schultz, 1989). Finegold et al (Finegold, Harris, & Von Gierke, 1992) fitted a logistic function to these data and this is what FICON recommended for the prediction of %HA for any given noise level. FICON recommended using this curve as the baseline for establishing noise impact and measuring impact magnitude.



Day - Night Average Sound Level in dB	40	45	50	55	60	65	70	75	80	85	90
Calculated %HA Points: USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Figure 3.1 Comparison of logistic fits to original 161 data points of Schultz (1978) and USAF analysis with 400 points (data provided by USAF Armstrong Laboratory).

Source: Fingold, L.S., Harris, C.S., and Von Gierke, H.E. as Presented in FICON (1992)

In this Noise Impact Evaluation Measure, this relationship between the percent highly annoyed and noise levels will be used to examine reductions in impacts by determining the change in the percent and number of population that is highly annoyed. An example of the percentage change (based on FICON 1992 Annoyance Curve) with a change in DNL noise level is illustrated in Exhibit 3-2. This exhibit shows that for a 1.5 dBA reduction in noise, the change in the percent Highly Annoyed would decrease by 13% to 19% depending upon the DNL noise level that the population is exposed to. For a 3 dBA reduction in noise, the change in %HA ranges from 25% to 34%. The percent reduction is greatest at the lower noise levels.

Although there is remarkable consistency in these surveys, which were produced using many studies in many countries and around many airports (see reviews by Job, 1988; Kryter, 1985), local conditions that affect the actual level of annoyance can clearly vary. One useful way to interpret differences among communities in their response to aircraft was offered by Green and Fidell (1991) based on a model proposed by Fidell, Schultz and Green (1988). The Fidell et al model determines a value called the "response criteria", which is a measure of the particular tolerance or sensitivity of a population, is called D*. This value is expected to vary among different regions with different local histories and conditions of exposure. A high value for the criterion indicates that people are inclined to report themselves as highly annoyed only when noise levels are higher; a low value means that people report high annoyance at relatively lower levels of noise. Regions populated by those with a low response criterion could be called "sensitive" and those whose residents have a high one could be termed "tolerant."

A survey of noise-induced annoyance in the communities surrounding Sea-Tac was performed by Fidell, Silvati and Pearsons (1995) and the average value of D* for the Sea-Tac area was determined. Interestingly, this value of D* indicates a relatively tolerant community around Sea-Tac as compared to the average from other studies. It can be seen that the numbers are close to those indicated by the FICON and Schultz curves, confirming the use of DNL as a measure of annoyance. In addition to using the FICON survey data, we will also use the %HA predicted using the Fidell et al Sea-Tac survey curve as another basis on which to assess changes in annoyance with aircraft noise around Sea-Tac. The percentage population that each prediction curve would report as highly annoyed at a given DNL noise level is shown in Table 3-4.

Exhibit 3-2
Example of Percentage Change in Highly Annoyed with Decrease in DNL Noise Levels (based on FICON curve)

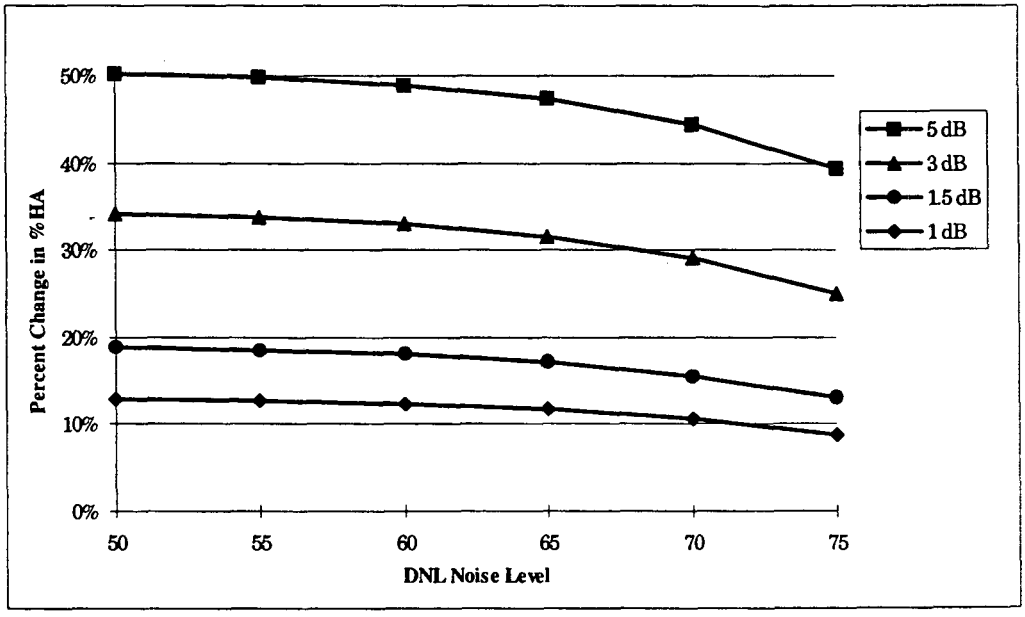


Table 3-4
Percent Highly Annoyed at Various DNL Levels

Prediction Curve	DNL Noise Level					
	50	55	60	65	70	75
FICON (1992)	1.7	3.3	6.5	12.3	22.1	36.5
Fidell et al (1995)	0.3	1.5	5.2	12.3	22.7	35.0

Increase Vs Decrease: Available research does indicate that using a Schultz-type curve to predict annoyance changes is warranted for both increases and decreases in noise level. It is observed that the FAA criterion for a significant noise increase, 1.5 DNL, results in a change in %HA that is roughly equivalent to the change for a 1.5 DNL decrease in noise level according to the Fidell et al (1995) survey data for annoyance around Sea-Tac.

The Port has reviewed the available studies which examine whether a change in aircraft noise level is reflected in a change in annoyance, and particularly whether an abrupt change in noise produces more or less annoyance change than would be expected from a Schultz-type curve. A summary of these studies is presented in Appendix C. As concluded from a meta-analysis of these studies (Fields, 1993), there is no consistent trend of results that could be construed as defining a meaningful change in noise, be it an increase or decrease, using annoyance as the metric. In some studies, changes in noise levels resulted in corresponding changes in annoyance while in others the noise changes had no apparent effect on annoyance levels. Unfortunately, all but one of these studies were concerned with the effects of abrupt changes in noise levels and so are not really relevant to assessing the effects of the gradual change enacted at Sea-Tac over the previous six years. The sole study that addressed the effects of a gradual change was completed in the 1960s and this addressed an increase in noise levels, not a decrease.

Thus, this research is of little help in deciding what constitutes a meaningful change in noise level. The one conclusion that can possibly be drawn from this limited research (including research on roadway and railroad noise) is that the most reasonable way to assess the effects of a change in noise levels is to refer the change in noise levels to a Schultz-type curve.

The simplest way to do this is to calculate from the equation for the relevant curve the %HA (Percent Highly Annoyed) for the "before" and "after" DNL values. These two values can then be used to estimate the change in %HA, or the percentage change (difference in %HA divided by the "before" %HA), as desired. Both increases and decreases in DNL can be evaluated this way, although the actual differences in %HA would not be expected to be exactly the same at all DNL levels since the curve is not symmetrical, and the asymmetry would become more important the larger the increase/decrease. This approach is supported, at least for abrupt changes, by the research reviewed by Fields (1993).

When this approach is taken, using the Sea-Tac version of the Fidell et al (1988) model curve, and for increases or decreases in the order of 1.5 DNL, for noise levels above 70 DNL the effects of increases and decreases in DNL on %HA are roughly the same. Below 70 DNL a slightly larger decrease is required to match an increase. For example, at 65 DNL a 1.5 DNL increase is equivalent to the same percentage change in annoyance as a 1.7 DNL decrease. At 60 DNL, a 1.5 DNL increase is equivalent to the same percentage change in annoyance as a 1.8 dBA decrease. This indicates that, according to the Schultz-type curve applied to Sea-Tac conditions, increases and decreases in DNL in this range can be expected to have roughly the same consequences for annoyance.

Considering the above, the Port considers it reasonable to conclude that guidelines for what constitutes a significant increase in noise level can also be used for decreases in noise level, within the constraints of the Schultz-type curve as illustrated. Given the rough equivalence (at least relative to annoyance effects) of increases and decreases in noise levels, the Port feels it reasonable to state that a decrease in DNL of 1.7 DNL is roughly equivalent to a 1.5 DNL increase, based on annoyance.

Analysis Methodology: The population data used in the previous measures will be used to predict the number of residents that would be considered highly annoyed by aircraft noise and how this number has changed since the base period. The FICON curve and the Fidell et al Sea-Tac survey curve will be used to predict the percent of the population that would be highly annoyed at various DNL noise levels. Based upon these data and the population within each contour zone, the total population predicted to be highly annoyed by aircraft noise can be determined. This analysis will also be completed for each study year to predict how annoyance would change over time. An example of how the data will be summarized is presented in Table 3-5.

Table 3-5
Example of Summary of Change in Population Highly Annoyed

Year	Population Highly Annoyed by Aircraft Noise	Reduction In Highly Annoyed Population
Base Upon FICON 1992 Annoyance Curve		
Base Period		
1993		
1995/96		
2001		
Based Upon Fidell 1995 Sea-Tac Survey Curve		
Base Period		
1993		
1995/96		
2001		

Additional Discussion About Non Acoustic Factors: Many factors influence how a sound is perceived and whether it is considered annoying to the listener. These include not only physical characteristics of the sound as measured by the noise metrics, but also secondary influences such as sociological and external factors. These secondary, or non-acoustic factors, can play a prominent role in affecting individual response to aircraft noise. Many of the Port's programs have been designed to minimize the impact of aircraft noise by addressing non-acoustic factors.

Results of annoyance surveys have been correlated with measures of various specific adverse effects on people (see Kryter, 1985). In particular, it is known that individual levels of annoyance depend on levels of activity interference (particularly speech interference and sleep disturbance), individual sensitivity, attitudes toward airport operations, location relative to the flight path, and other non-noise effects, in addition to the actual noise level experienced (Taylor, 1984). Interestingly, one of the most important determinants of individual annoyance level seems to be the extent to which the airport is perceived to have tried to minimize noise levels; the perceived importance of airport operations is also important (Taylor, 1984).

Recently Fields (1993) reported a meta-analysis of 464 findings drawn from 136 surveys that addressed a wide variety of non-acoustic effects on annoyance. He studied only findings that met at least one of six criteria for an "important" classification, including standard statistical criteria and reasonable although arbitrary effect-size criteria (e.g., an annoyance difference equivalent to a 3-dB difference in noise exposure, or a 5 % difference in %HA). He also classified the findings as standard (high quality) or nonstandard (lower quality). He concluded that the balance of the evidence indicates that annoyance is not importantly affected by time at home, type of interview, age, sex, social status, income, education, home ownership, type of dwelling, length of residence, or benefit from the noise source. However, annoyance is importantly affected by isolation from sound at home, fear of danger from the source, noise prevention beliefs, noise sensitivity, beliefs about the importance of the noise events, and annoyance with non-noise impacts of the noise source.

The findings concerning the effects of isolation from sound at home are important in that they generally support the usefulness of home insulation programs. Fields (1993) reported that the two studies that measured both annoyance and sound attenuation before and after insulation was installed found that annoyance decreased when the insulation made the noise less audible. One of these studies focused on aircraft noise around Schiphol and Marssum airports in Holland (de Jong, 1981, cited in Fields, 1992). In this study, new sound insulation reduced noise levels inside homes by 5 to 20 dBA and annoyance by the equivalent of 3 dBA at 7 of 8 locations, on average. Less reduction in annoyance than expected was obtained at the lower noise levels but the reduction was more than expected at higher noise levels. A more recent study not analyzed by Fields was reported by Fidell and Silvati (1989). They compared annoyance of residents in insulated and uninsulated houses in the course of a home-

insulation program near Hartsfield Airport in Atlanta, Georgia. Overall, the difference in %HA between insulated and non-insulated homes was about 7 percent, with insulated homes having the lower value. However, the annoyance reduction attributed to insulation was not statistically reliable. The results of that study, together with the failure to actually measure indoor exposure levels and to differentiate between annoyance when indoors and when outdoors (Atlanta has a warm climate and residents can be expected to spend considerable time out-of-doors), indicate that the effects of insulation are complex and may interact with other factors, such as climate, that encourage spending more time in outside activities. Nonetheless, it does appear that insulation programs, such as those undertaken by the Port around Sea-Tac Airport, have a beneficial effect in decreasing annoyance. We have not, however, factored this potential beneficial effect into the analysis of the percentage reduction in annoyance.

Fields' (1993) conclusions are also consistent with the earlier material in pointing toward several attitudes as being very important non-acoustic mediators of annoyance, especially those that would be affected by an understanding of an airport's efforts to mitigate noise, beliefs about the preventability of the noise, and annoyance with non-acoustic impacts of the airport operations. All of these factors are significantly addressed by the inclusion of public input in the noise management and mitigation process (including noise complaint hotlines) and by public information that informs the residents of noise exposure areas. Similarly, public awareness can be addressed directly to the problem of noise control. For example, the elimination of aircraft power backs had little effect on the actual noise environment. However, it addressed non-acoustic factors because aircraft power backs were a noise source that the public felt was not necessary.

All of these kinds of actions by airports address the complex of non-acoustic factors that can affect the relationship of noise and annoyance. These actions can be expected to directly decrease annoyance. In terms of the Fidell et al (1988) model, the mechanism of the annoyance decrease could be understood as a change in the threshold for describing oneself as highly annoyed. The more that an airport addresses these non-acoustic factors, the higher will be the potential threshold of high annoyance.

As outlined in Chapter 2, the Port has a history of encouraging public involvement beginning in the mid-seventies with the Sea-Tac/Communities Plan. In particular, the Noise Mediation Project implemented in 1990 involved considerable public input and extensive publicity through many public meetings and workshops (see Appendix D.) The public participated as an equal partner and dealt directly with those in authority at the airport (the Director and Assistant Director). The Port believes that this process was very effective in addressing the non-acoustic factors that influence annoyance in the Sea-Tac area.

It has been noted that the threshold for high annoyance is higher at Sea-Tac than at the average airport, indicating a more tolerant population. It is interesting to note that the survey showing this occurred during a time of great publicity about airport expansion. This higher threshold for annoyance may be caused by several factors, including the fact that Seattle is the locus of one of the world's largest aircraft design and manufacturing companies. However, the higher annoyance threshold is also consistent with the Port's efforts to address the non-acoustic factors described above by encouraging public involvement, especially through the Noise Mediation Project and followup committee. The Port believes that its noise abatement program includes efforts that address reducing non-acoustic factors.

Measure D. Reduction in Population that May Experience Sleep Disturbance

Description: Sleep interference is a major noise concern in aircraft noise assessment and, of course, is most critical during nighttime hours. Noise can make it difficult to fall asleep, create momentary disturbances of natural sleep patterns by causing shifts from deep to lighter sleep stages, and cause awakening. This criterion is a measure of the reduction in the number of people that would potentially experience sleep disturbance as a result of nighttime aircraft operations.

Supporting Information: This section describes the research on the effect of aircraft noise on sleep disturbance, including both: 1) the laboratory research that was generally accepted at the time that the Nighttime Limitations Program went into effect and 2) more recent field studies on sleep disturbance.

Aircraft noise has been shown (in laboratory and in-home and field studies) to interfere with going to sleep and to cause unwanted awakenings and other sleep disturbances (see FICON, 1992; Kryter, 1985; WHO, 1980). These effects can be succinctly summarized by a graph of percentage of the population expected to be awakened as a function of individual aircraft event noise level, expressed as indoor SEL in decibels. This is shown in Exhibit 3-3, which is taken from the FICON report and summarizes the results of many studies (Finegold, Harris & Von Gierke, 1992). Exhibit 3-3 includes an equation from which the expected percentage of awakenings can be calculated once the SEL of a noise event is known, although there are no standards to decide how many awakenings constitute a problem. It is clear from the graph that as noise level increases, so does the percentage of people affected.

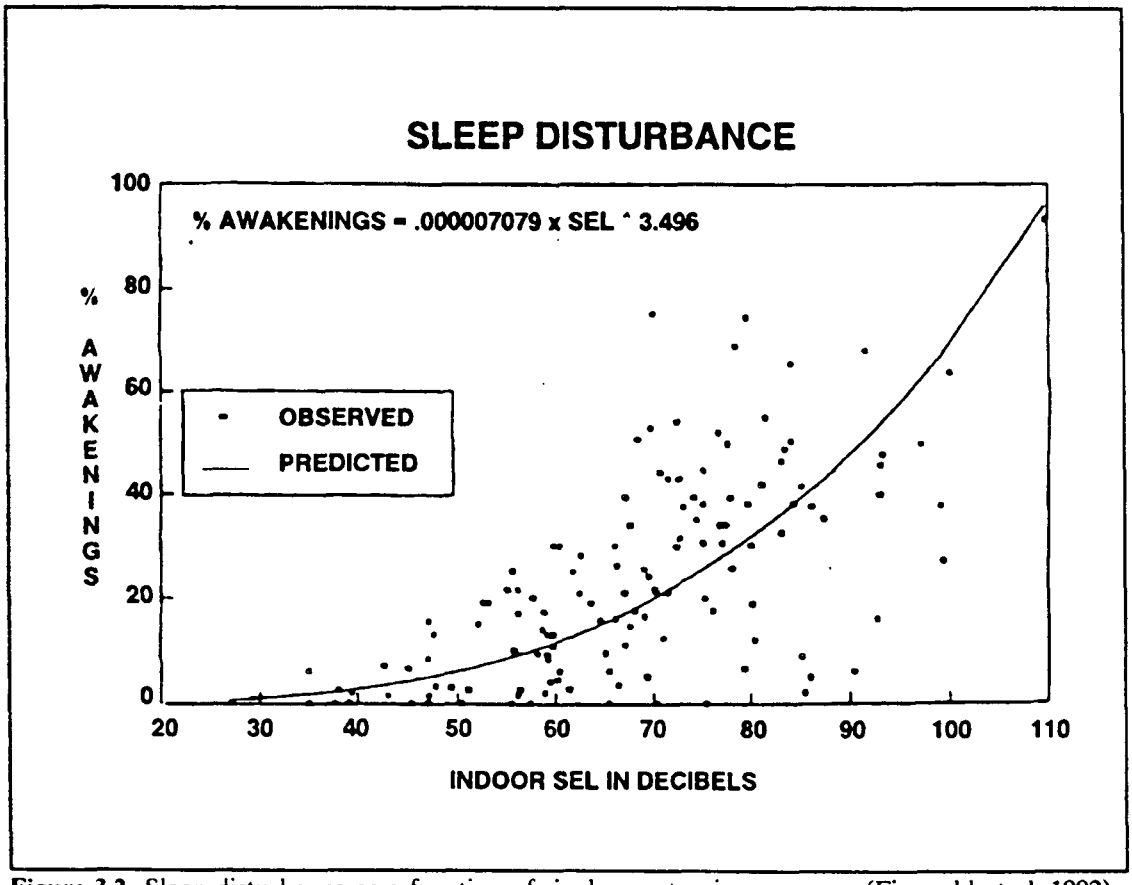
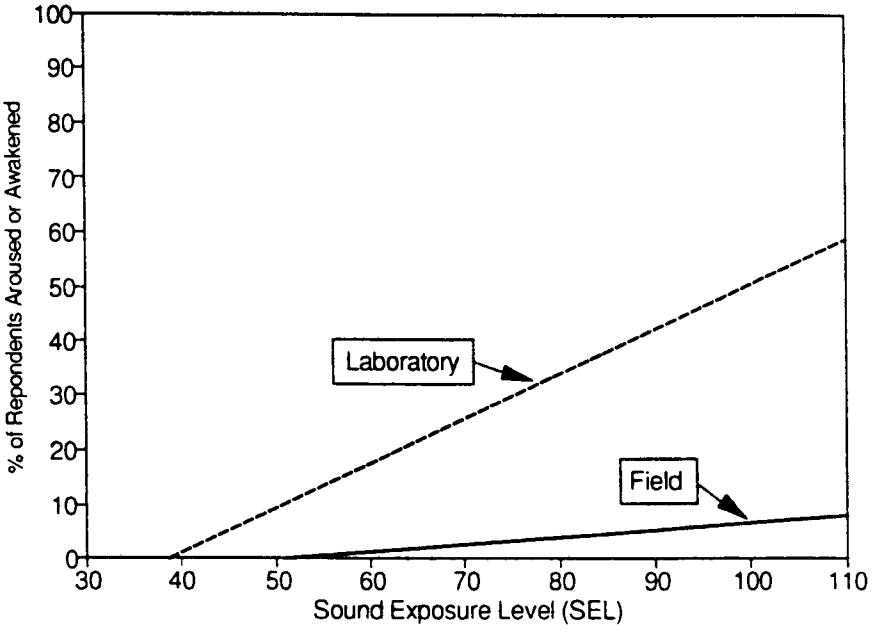


Figure 3.2 Sleep disturbance as a function of single event noise exposure (Finegold et al. 1992)

Source: Fingold, L.S., Harris, C.S., and Von Gierke, H.E. as Presented in FICON (1992)

The summary of the sleep studies shown in Exhibit 3-3 does not consider a result emphasized by the original reviewers of the studies (Pearsons et al, 1989). Pearsons et al (1989) pointed out a significant divergence between laboratory studies and field studies for the relationship between SEL and percent awakenings. Their summary of the same data separated into laboratory and field studies is presented in Exhibit 3-4. It is clear from the figure that most laboratory studies predict much greater numbers of awakenings at the higher noise levels than were found in the relatively small number of field studies reviewed.



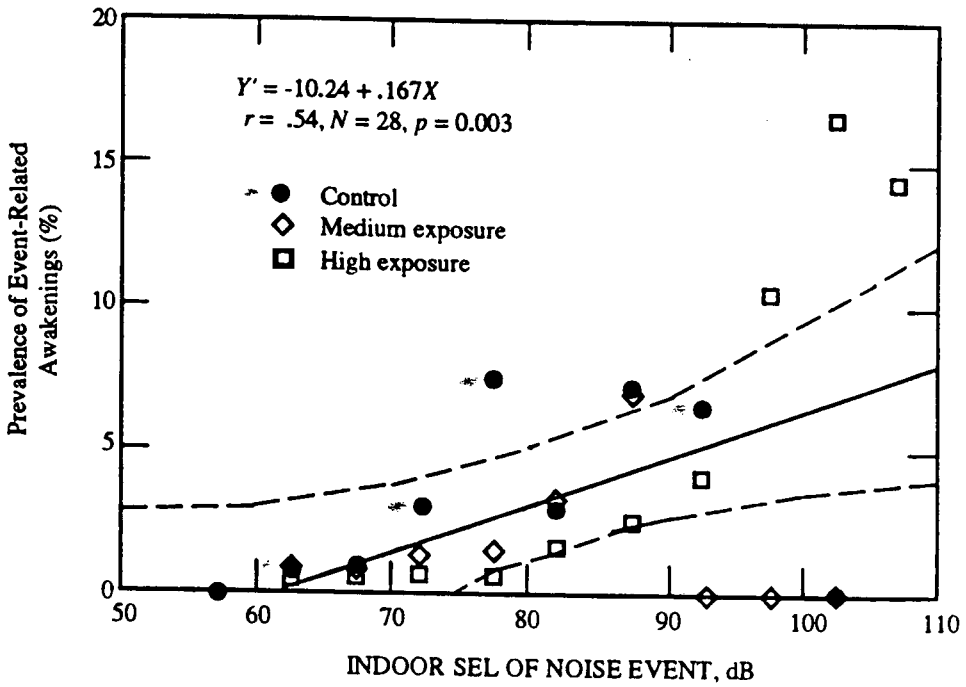
Summary of dosage-response relationships developed by Pearsons et al. (1989) between awakenings or arousals and indoor sound exposure levels.

Source: Pearsons, K.S., Barber, D.S., and Tabachnick, B.G. (1989). "Analysis of the predicability of noise-induced sleep disturbances." HSD-TR-89-029. Brooks AFB Texas, USAF, Human Systems Division, HSD/YA.

Two recent field studies done to increase the amount of available field data found results similar to the field studies reviewed by Pearsons et al (1989). One of these new studies was a very thorough field study of sleep disturbance in the vicinity of several British airports (Ollerhead, et al 1992). In this study, sleep disturbances were measured by an actimeter (an instrument that is worn on the wrist and that detects slight movements of the hand and arm). A very large amount of data was collected (4.6 million 30-second epochs collected from 400 subjects over 5742 subject-nights) and was very carefully analyzed with sophisticated statistical techniques. The study found that the arousal rate during epochs with outdoor aircraft noise event levels in the range of 80-95 dBA Lmax (indoors about 60-75 dBA) was about 5.8% to 7.8%, which is somewhat lower than predicted by the studies summarized in Exhibit 3-3, although within the range of the field studies summarized in Exhibit 3-4. However, the overall percent of quiet epochs with arousals from all other sources was about 5.3%, or about 45 arousals per night. Of these about 18 lasted for 10-15 sec or more. Ollerhead et al (1992) argued that in this context, and given the relatively low incidence of "noisy epochs," the relatively few arousals directly attributable to aircraft noise (arousals during noisy epochs minus the "normal" 5.3% arousals in quiet epochs, or about 0.5% to 2.5% for events in the range mentioned earlier) posed no significant health hazard to the average person living near any of the study airports. However, they also found that individual rates of sleep disturbance varied markedly, with the 2-3% most sensitive people possibly being more than twice as likely as the average person to have their sleep disturbed.

The second recent field study was done for the USAF by Fidell et al (1994) and was the study promised by the USAF during the FICON (1992) report. In this study, awakening was measured by the press of a button and noise levels were monitored in the bedroom of each study participant. Exhibit 3-5 shows a summary of their findings in a form comparable to the previous exhibits. Again, although the number of awakenings associated with aircraft noise events increased reliably with the SEL of the noise events, the number of awakenings attributable to aircraft noise was small. This result is consistent with the Ollerhead et al (1992) results and the Pearson et al (1989) field study curve and much lower than predicted by the laboratory studies referenced in the FICON study. For example, for an indoor SEL event of 70 dBA, the FICON curve predicts about 20% awakenings while the Fidell et al (1994) results predict about 1.45% awakenings.

In summary, although there may be considerable discussion about which results should best provide informed predictions about the effects of aircraft noise on sleep, there is consensus that such effects exist and that they increase in number with increasing noise levels. The results of the two recent field studies of Ollerhead et al (1992) and Fidell et al (1994) imply that the results from the field data are more appropriate to use for impact evaluation than are the laboratory data results.



Prevalence of behavioral awakening responses occurring within five minutes of noise events, aggregated by test participants within sites, in 5 dB increments. (Note exaggeration of vertical scale.)

Source: Fidell, S. , Pearsons, K., Howe, R., Tabachnik, B., Silvati, L. and Barber, D.S. (1994) Noise-induced sleep disturbance in residential settings. Final Report to the Air Force Material Command. Wright-Patterson Air Force Base, Ohio, USA.

Analysis Methodology: The noise data from the noise measurement survey will be used to predict the potential for sleep disturbance around Sea-Tac and how that potential may have changed over time. The research into sleep disturbance is primarily based upon single event noise data. To illustrate the effect of the changes in single event noise levels on sleep disturbance, the average daily number of nighttime aircraft events above various indoor SEL levels will be determined for each of the study years. These data will be directly compared to the results of sleep disturbance research to determine the potential for sleep disturbance to occur. The average number of potential awakenings per night will be calculated based upon the number of people, the number of events at each indoor noise level (using the results of Fidell et al 1994) and the percentage awakenings at that noise level.

Because the SEL noise levels vary depending upon the location relative to the Airport, the analysis will select RMS noise measurement location(s) that are representative of noise impact zones which are designed to represent a range of noise exposure from high to low. These zones are proposed to be based upon the Base Period DNL noise contours between 75 and 55 DNL and the population within these contours. Noise measurement location(s) and the associated SEL measurement results will then be selected to represent that zone. For example, RMS 2, 3, 5, 7, 9 and 10 of the permanent noise monitoring system might be used to represent the 65 to 75 DNL zone.

The analysis will determine the number of SEL events for each SEL level for each of the study years under consideration. The indoor noise levels with and without windows open and for insulated/uninsulated homes will be determined to show the indoor single event levels. The change in the number of insulated homes for each year will also be included in the analysis.

The building noise reduction can be determined from noise measurements conducted by the Port's Noise Remedy Office. The Noise Remedy Office has conducted many measurements of building attenuation levels for homes before and after sound insulation was installed. The average building attenuation prior to insulation will be determined from this data. (For windows open, a value of 15 dBA building attenuation will be utilized.) Building attenuation levels for post-insulation construction can also be determined from Noise Remedy Office data. From these measurements, the average post-insulation building attenuation for each of the Noise Remedy zones will be used calculating indoor single event noise levels for insulated homes.

Measure E. Reduction in Population and Percent of Time with Speech/Activity Interference (Indoor/Outdoor and Classroom)

Description: Speech and activity interference is a potential noise impact from aircraft noise. Speech/activity interference can be described relative to both outdoor and indoor interference. Speech and classroom learning interference is also a potential impact from aircraft noise. The learning interference can be described relative to indoor speech interference during the classroom hours.

This measure assesses the reduction in the magnitude and degree of speech/activity interference for residences and for school classrooms at various distances from the airport. The beneficial effects of the noise insulation program can also be factored into this analysis.

Supporting Information: In addition to speech communication, noise can affect various other activities. Activities that are frequently listed as susceptible to interference by noise are described in Table 3-6 (from Miller, Von Gierke, & Eldred 1991). These results show which indoor activities have the greatest potential for interference.

Table 3-6
Activity Disturbance in Residences Due to Aircraft Noise

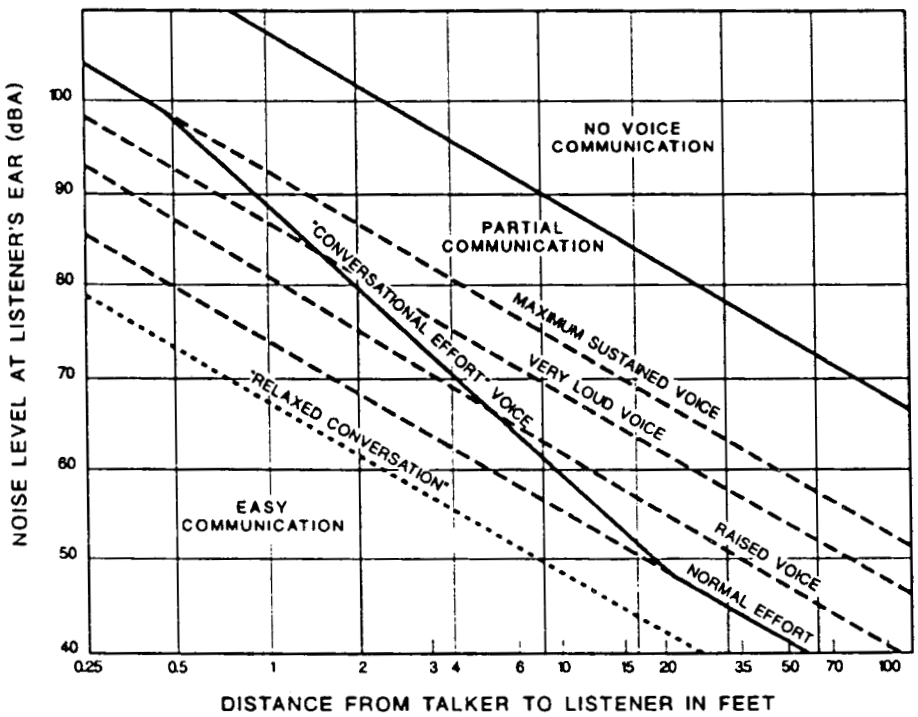
Activity	Percent
TV/Radio Reception	20.6
Conversion	14.5
Telephone	13.8
Relaxing Outside	12.5
Relaxing Inside	10.7
Listening to Records/Tapes	9.1
Sleep	7.7
Reading	6.3
Eating	3.5

Sounds from different sources mix. Whether the listener is outside or indoors, the broadband sound generated by an aircraft flyover can mix with speech sounds from conversations or from radios and television sets, as well as with other wanted sounds. Such sound mixing produces masking, which interferes with speech intelligibility and other aspects of sound perception. Speech typically is produced in such a way that its sound level near a listener is about 45-65 dBA, depending on its purpose. Thus, the effect threshold for indoor speech masking varies with the purpose of the conversation but is seldom lower than about 45 dBA (cf. Kryter, 1985).

FICON (1992) set the effect threshold for interference with indoor speech communication by intrusive noise at 60 dBA, presumably assuming that people can be expected to speak near the upper limit of the normal range (65 dBA) without exerting special effort. When speech masking is present, people can, and do, increase the effective sound level of the speech, either by decreasing the distance from speaker to listener or by increasing the speaker's loudness. However, at noise levels at or above 80 dBA speech intelligibility is near zero even if a raised voice is used (FICON, 1992). Exhibit 3-6 presents the speech levels necessary for communication under various distances and background noise conditions.

Sounds from aircraft flyovers can be expected to cause speech masking. A typical aircraft flyover might cause above-background noise for 30 seconds or so, with at least a 10 second period around the moment of Lmax being the most intense. The effects of indoor speech masking for normal voiced speech is summarized in Exhibit 3-7 (Miller, Von Gierke, & Eldred 1991). This exhibit assumes that the indoor space has typical reverberation that is a result of reflections from the walls and other boundaries of the room. This exhibit shows that 45 dBA is the maximum interior sound level that will permit relaxed conversation with normal voice effort and 100% sentence intelligibility throughout the room. At higher noise levels, the degree of sentence intelligibility decreases or the talker must raise their voice to communicate.

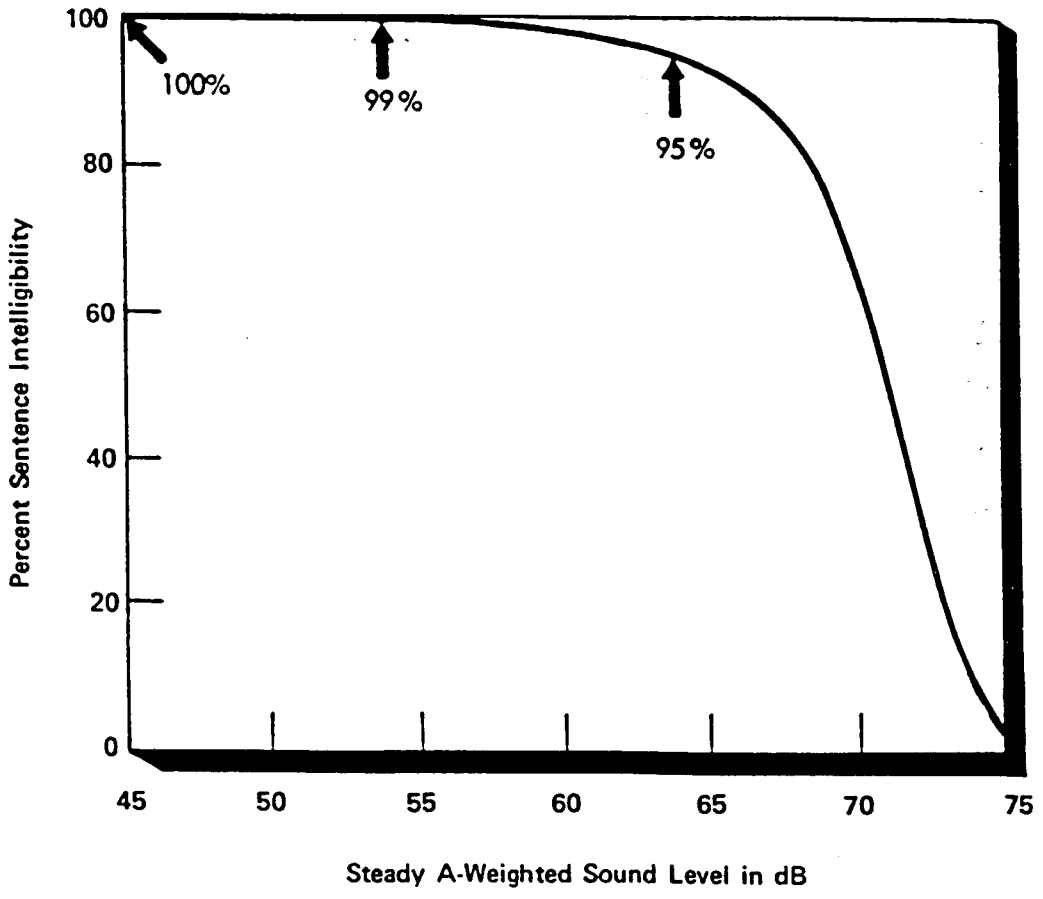
In order to estimate the change in the amount of speech interference over the study period, we will determine the amount of time during which the indoor sound level would be greater than 45 dBA and greater than 60 dBA for several zones around Sea-Tac. The Time Above 45 dBA would reflect when speech masking is at or above the threshold of indoor speech interference. The Time Above 60 dBA would reflect the time at or above moderate indoor speech masking when voice levels near the higher end of normal speech would be necessary for communication. The zones will include those with higher noise exposure and those with lower noise exposure. The effects of sound insulation on indoor sound level will also be included.



Source: U.S. EPA 1973

Source: As Presented in EPA (1974)

Exhibit 3 - 7
Indoor Speech Interference for Relaxed Conversation
with a Normal Voice Level in Typical Living Room



Source: Miller, N.P., von Gierke H.E., Eldred, K., "Impact Assessment Guidelines for the Effects of Noise on People", Prepared for Transport Canada, HMMH Report # 291060.01 March 1991.

Outdoor speech interference is also important, but as shown in Table 3-6, is less critical than indoor speech/activity interference. The airport's noise monitoring system measures the Time Above 65, 75 and 85 dBA values. These values can be used to illustrate degrees of outdoor speech masking. The Time Above 65 dBA will be used to reflect the time at or above low level speech masking when people need to speak at or above the high end of the normal communication range. The Time Above 75 dBA will be used to reflect the time at or above mid level speech masking when raised voices above normal speech would be necessary for communication. The Time Above 85 dBA will be used to reflect the time at or above high level speech masking when communication is difficult. Changes in the impact of aircraft noise on speech and activity interference will be described by shifts in the distribution of amount of time when noise levels were in the various intensity bands. A shift of the distribution away from the higher and toward the lower bands would indicate a reduction in the severity of aircraft noise interference with speech and related activities.

Noise interference with the learning process and school activities can be described by the following effects:

- Interruption of communication
- Distraction by the noise stimulus
- Effects of noise on task performance
- Annoyance

In the classroom setting, verbal communication, both teacher-student and student-student, is important for optimal learning and reasonable discipline. Questionnaire studies have shown that the most common effect of aircraft noise on classroom activities is interference with speech and with the use of audio-visual aids. Criteria for speech communication in the classroom are LEQ(1) values of 45 to 50 dBA. For practical purposes, this is similar to the 45 DNL indoor noise criterion for residential land uses.

FICON notes that no quantitative relationship has been established between speech interference and learning in school classrooms, and therefore studies have not developed any additional criteria to quantify speech interference effects on learning. However, FICON does note that if speech communication is degraded, then the learning process can also be affected.

As a result, this analysis of the effect of aircraft noise on classroom speech communication will utilize the same analysis as the indoor speech interference analysis. The difference will be that the Time Above analysis will be for classroom hours and not the 24-hour period normally used for Time Above.

In order to estimate the change in the amount of classroom speech interference over study period, we will determine the amount of time during which the indoor sound level would be greater than 45 dBA and when it would be greater than 60 dBA at example schools around Sea-Tac. The Time Above 45 dBA would reflect when speech masking is at or above the threshold of indoor speech interference. The Time Above 60 dBA would reflect when the noise level is at or above moderate indoor speech masking so voice levels near the higher end of normal speech would be necessary for communication. The analysis zones will include those with higher noise exposure and schools with lower noise exposure. The effects of sound insulation on indoor sound level will also be included.

Analysis Methodology: The residential indoor analysis will be designed to determine the change in the potential for residential indoor speech interference. The change in the number of insulated homes will also be included. The areas around the airport would be divided into noise impact zones based upon the Base Case noise contours. This will illustrate how change occurs in both the higher and lower noise zones. The indoor analysis will present the Time Above 45 and 60 dBA to represent the amount of time the noise is at or above the threshold for speech interference and moderate speech/ activity interference occurs. The residential outdoor analysis will present the Time Above 65, 75 and 85 dBA (minutes above for a 24 hour period) to represent the amount of time the noise is at or above low, medium and high levels of speech interference could occur.

For classroom speech interference, the Time Above noise data determined from the noise measurement survey will be used to illustrate the change in the potential for classroom speech interference. Many of the noise monitoring locations are located at or near school sites. The measured and predicted noise levels for these locations will be determined for a typical classroom day. The data that will include the indoor Time Above 45 dBA and indoor Time Above 60 dBA. The building noise reduction levels for these classrooms (both with and without noise insulation) will be estimated to determine the indoor classroom Time Above values. This information will be calculated for each of the study years under consideration. The Time Above levels will be compared from year to year to show the degree of change in speech interference.

Measure F. Reduction in the Number of Residences with Indoor Noise Environments in Excess of 45 DNL

Description: Providing for an acceptable interior living noise environment is an important goal of the Port of Seattle Noise Control Programs. An interior noise level of 45 DNL is one of the design standards of the noise insulation program. This noise reduction goal is a measure of the reduction in the number of residences that have indoor noise environments in excess of 45 DNL.

Supporting Information: Various agencies have developed guidelines for acceptable interior noise environments for residential land uses. In 1974, the EPA (EPA, 1974) identified 45 DNL as the interior noise level requisite to protect public health and welfare with an adequate margin of safety. The level was established to minimize the effects of indoor activity interference and annoyance and included a 5 dB safety factor. The Department of Housing and Urban Development (HUD) has developed DNL standards for new construction financially assisted or supported by the Department. The HUD standards effectively require the interior noise level to be 45 DNL or less.

Analysis Methodology: The change in the number of homes exposed to an interior DNL noise level in excess of 45 will be determined from the noise contour analysis and from indoor noise measurements conducted by the Noise Remedy Office. As previously described, noise contours will be developed for each of the study years under consideration. The outdoor noise exposure level will be on the contour information.

As described earlier, the Noise Remedy Office has conducted many measurements of building attenuation levels. The average building attenuation prior to insulation will be determined from this data. For windows open, a value of 15 dBA building attenuation will be utilized. Building attenuation levels for post-insulation construction can also be determined from Noise Remedy Office data. From these measurements, the average post-insulation building attenuation for each of the noise impact zones can be determined.

Based upon this information, the total number of residences with interior noise levels greater than 45 DNL can be estimated for each of the study years. These results will reflect both the changes that occur as a result of the reductions in overall noise and the changes that occur as a result of the noise remedy insulation program. An example of how this data will be presented is shown in Table 3-7.

Table 3-7
Example of Number of Residences Exposed to Indoor Noise Levels in Excess of 45 DNL

People	Study Year			
	Base Period	1993	1995/96	2001
Number of Residences				
Windows Open				
Windows Closed				
Reduction over Base Period				
Windows Open	--			
Windows Closed	--			

3.3 Context Considerations

The following are considerations for the Panel to include in their evaluation of meaningful. These additional indicators of performance can be used to confirm and put into context the consistent pattern of improvements in noise impacts for people. These considerations are discussed in more detail on the following pages.

- Context Consideration 1: Are Sea-Tac's noise programs a result of public participation efforts that identified noise programs that could be expected to have meaning for people?

- Context Consideration 2: Is the Port following through on its commitments to the noise reduction programs?

- Context Consideration 3: Do the noise reduction measures use all that is practically and reasonably available to the airport?

Context Consideration 1

Are Sea-Tac Airport's noise programs a result of public participation efforts that identified noise programs that could be expected to have meaning for people?

The extent of a public participation process offers a good indication of an agency's intent to identify what is important to the public. Sea-Tac Airport has historically taken highly visible, public approaches to important projects. Going back to 1975 with the Sea-Tac/ Communities Plan and continuing through the development of the Mediation Agreement in 1990, the Port of Seattle has had an extensive public involvement program.

The focus of the Port's public involvement program for noise issues has been the Noise Mediation Project. This project resulted in the implementation of Sea-Tac's major noise reduction programs and improvements to the Acoustical Insulation Program. This approach combined technical and legal expertise with unprecedented opportunities for local citizens to be active participants in the development of noise reduction programs that they would consider meaningful and significant. The implementation of these programs is monitored today by a committee representing the involved communities.

We do not infer that the Mediation Project alone fulfills the Port's mission in active public participation on noise issues. Continuing mechanisms for public participation include two noise offices, Noise Remedy and Noise Abatement, continuing study efforts on noise issues, such as the Part 150 process, and public input at Port Commission meetings. Under Port Commission and FAA direction, the Port updates the Part 150 every five years. The next update is scheduled to begin in 1996.

As the Panel evaluates whether Sea-Tac's reduction of noise impacts are meaningful, consideration should be given to the processes the Port has used to actively involve the public in the development of the noise reduction programs. In other words, are the noise abatement programs addressing issues that the public helped define as important and meaningful? Special consideration should be given to the Mediation Project which serves as the baseline for our current noise reduction programs. More detailed information on public involvement is included in Appendix D.

Context Consideration 2
Is the Port following through on its commitments to the noise reduction programs?

Through the various programs sponsored by the Port of Seattle, including the Noise Mediation Project, noise control measures at Sea-Tac Airport have been implemented. These measures were designed to provide for reductions in noise, reductions in the associated noise impacts and to address particular issues of concern that have been expressed by the community. Major elements of the Noise Control Programs are listed below:

Noise Remedy Program
- Noise Insulation Program
  - Single-family residential
  - Multi-family residential
  - Public use buildings
  - Public schools
- Transaction Assistance Program
  - Special Purchase Option
- Acquisition Program

Noise Abatement Program
- Noise Budget
- Nighttime Limitations
- Flight Track Monitoring
- Ground Noise Restrictions
- Part 150 Noise Analysis
- Public Involvement and Information Program

Chapter 2 of this document explains the details of these programs. For purposes of this discussion, each program is summarized and a recommended method of evaluating the results is described. Since many of these programs are ten year programs through 2001, the Port believes the Expert Panel should evaluate if, for the 1996 time frame, the Port is on schedule for meeting the program goals.

Noise Remedy Program

Summary Description: The Noise Remedy programs include Acoustical Insulation, Transaction Assistance and Acquisition. The Port, in working with the community, FAA and airlines, initially developed the Noise Remedy Program as part of the Sea-Tac/Communities Plan. It was then included in the airport's first FAR Part 150 study, which was approved by the FAA in 1985. Original elements included the acquisition program, single-family residential insulation program and transaction assistance program. The Noise Remedy Program was enhanced and accelerated through the Noise Mediation Process in 1990, including the addition of the special purchase option and a modification to the "cost-share" feature of the insulation program. "Cost-share insulation" required that the home owner pay for part of the insulation. The Mediation Agreement changed the cost-share to the standard insulation package concept, for which no out-of-pocket costs are required of the homeowner (refer also to Appendix A).

The acoustical insulation program was further accelerated and expanded in 1992 with Commission Resolution 3125 and through FAA approval of the 1993 Part 150 Update. Resolution 3125 directed staff to greatly accelerate the single-family residence program. Those who have signed up for the program by the end of 1993 are to be insulated by April 1996. All other volunteer participants are to be completed by 2001. The Commission also directed that staff develop plans for including multi-family buildings, public use buildings and public schools in the insulation program (refer also to Appendix B).

Evaluation Methodology: The goals for the Noise Remedy Program that are relevant to the PSRC resolution include the following. The Port believes that the Panel should evaluate whether the Port is on schedule for achieving these goals.

1. Current insulation rate of 100 single family homes per month;
2. Completion of pilot insulation projects on 2 churches, 1 convalescent home, a private school and a condominium by April, 1996 with plans and timelines for implementation of full programs;
3. Continuation of insulation funding to Highline Community College;
4. Invitation to Highline School District to reopen discussions on providing insulation and developing a noise mitigation and funding plan;
5. Transaction Assistance available to homeowners within the "Neighborhood Reinforcement" area;
6. Completion of Part 150 Acquisition Program;

Noise Abatement Program

The Noise Abatement Program deals directly with the source of the noise, the aircraft operations themselves. The major noise abatement programs at Sea-Tac Airport were developed through the Noise Mediation Project and include the Noise Budget and nighttime restrictions on Stage 2 aircraft. The Noise Abatement Program also includes restrictions on engine testing, especially at night, a prohibition on the use of engine power to back up at gates, monitoring and reporting of compliance with Sea-Tac noise abatement procedures, and monitoring of airport noise. Additional programs include updates to Sea-Tac's noise exposure maps and noise compatibility program and a public involvement and information program, including an information and noise complaint line.

Noise Budget

Summary Description: The Port of Seattle, through the Noise Mediation Agreement, has committed to specific noise reduction goals within the Sea-Tac Noise Budget. The Noise Mediation Committee established these noise reduction goals and included specific target annual noise levels from 1991 through the year 2001. These limits are determined through a mathematical formula based on the noise metric ANEL. The ANEL metric was designed as a measure of the overall noise around an airport and reflects changes in operations and fleet mix in a similar manner as DNL. An important evaluation measure is to show that at the midpoint of the program, 1996, the Port's commitments for this measure of the overall noise levels are actually being met.

Evaluation Method: The reductions in noise levels that are contained in the Noise Budget are presented in Chapter 2. If the actual airport ANEL noise level for 1995/96 meets or betters the scheduled Noise Budget reduction goals, then this measure of meaningful noise reduction has been achieved. Note that this evaluation is not the same as the Noise Validation Methodology that translates the ANEL reductions to actual, measured reductions in DNL noise levels (see Evaluation Criterion 1). This measure simply assesses whether the ANEL noise reductions per the Noise Budget formula have occurred.

Nighttime Limitations Program

Summary Description: Both prior to and during Noise Mediation, nighttime aircraft operations were one of the key areas of concern expressed by the community. As a result, the Noise Mediation Agreement contains a provision that limits nighttime operations of Stage II jet aircraft over 75,000 lb. at the Airport. The program, agreed upon in March of 1990, went into effect on October 1, 1990. This limitation program first applied to new Stage II operations between the hours of midnight and 6 a.m. It has been incrementally expanded to its full extent. As of October 1, 1995 program applies to all Stage II operations between the hours of 10 p.m. and 7 a.m. International flights operating under bilateral agreements are exempted (currently, all nighttime international flights use Stage 3 equipment). Under certain conditions, airlines may obtain exemptions or variances from the rules. The Nighttime Limitations Program is described in detail in Chapter 2.

Evaluation Methodology: The Nighttime Limitations restriction is not written in terms of a noise limit, as is the Noise Budget, but in terms of an operational limit based on aircraft certificated noise levels. Thus, the implementation of this program is evaluated by showing that the Port has made reasonable efforts to apply and enforce the Stage II operations limits during the nighttime restricted hours in accordance with the terms of the restriction.

To facilitate the Panel's evaluation, the Port of Seattle will provide operational data that includes the total number of jet operations during the nighttime hours, and a breakdown of these operations in terms of the Stage of aircraft and compliance with the restriction. This information is routinely reported to the public in the Quarterly Noise Report. Where available, data that will be provided on an annual basis include:

Stage III Operations
Stage II Operations
Stage II Variance Operations
Stage II Exempt Operations

The methods developed by the Port to document and enforce the program will also be described as well as how this information is made available to the public. The enforcement and accountability was greatly enhanced with the purchase and installation in late 1992 of the ANOMS flight tracking software that allowed for improved enforcement. As a result, operational information is more complete for the most recent years.

Ground Noise

Summary Description: Ground noise is considered to be the noise produced by the operation of aircraft while still on the ground at the Airport. This noise includes that produced by aircraft on takeoff roll, thrust reverses on landing, taxiing, powerbacks, ground power, and maintenance runups. The Noise Mediation Agreement included provisions for elimination of aircraft powerbacks, enhancements of the monitoring of aircraft maintenance runups, and future study of ground noise sources. The PSRC specified that the run-up and powerback restrictions are responsive to their intent regarding ground noise.

Evaluation Methodology: The Port believes that the Expert Panel should review the monitoring and enforcement of the run-up and powerback restriction programs to determine if reasonable efforts have been made to meet these commitments.

Flight Track Monitoring

Summary Description: Over the years the FAA, in consultation with the Airport and surrounding airport communities, has implemented a number of flight track procedures intended to minimize the impact of overflight noise to residential communities around the Airport. Sea-Tac Airport monitors and reports on a number of noise abatement departure and arrival procedures. These procedures include:

Initial departure headings (north flow & south flow)
Duwamish/Elliott Bay nighttime departures
Puget Sound nighttime departure procedures
East Turn Nighttime Departure Curfew
Duwamish/Elliott Bay nighttime arrivals

Because an issue of concern to the community has been aircraft adherence to following the noise abatement flight tracks, the Mediated Agreement included provisions to phase-in an upgrade to Sea-Tac's flight track monitoring system and to measure compliance with specific procedures. As a result, the Port purchased flight tracking hardware and software, entered into a Memorandum of Understanding with the FAA to obtain its radar data, and developed programs to monitor compliance with the noise abatement flight procedures. The level of compliance with each of the procedures is routinely reported in the Quarterly Noise Report. All of the initial departures are monitored and all noncomplying events are reported to airline chief pilots. Trend monitoring is done on the other procedures, with results reported to SNAC, FAA, and airlines.

Evaluation Methodology: The Port believes that the Expert Panel should review the efforts of the Port in developing and implementing a program to monitor compliance with the noise abatement flight procedures and determine if these programs are responsive to commitments concerning flight track monitoring.

Public Involvement and Information

Summary Description: Providing avenues for the two-way exchange of information is an area in which the Port of Seattle has focused much time and attention. Available opportunities for this exchange within the Noise Remedy program include: participating on the Insulation Hardship Committee; attending homeowner briefings; attending or participating on the Public Buildings Advisory Committee; attending contractor briefings; attending contractor forums; attending the twice-a-year open house (advertised in several local newspapers and airport newsletters); and calling the published front desk phone number which is staffed full time. Information opportunities in the Noise Abatement Section include: attending the noise office open house; registering complaints and requesting information or a response back on the Noise Information Line; requesting a flight investigation; talking with Noise Abatement Office staff; attending tours of the noise office, which include demonstrations of the computer equipment; receiving informational mailings, such as the noise office quarterly report (4,000 people on the mailing list), program reports, airport newsletters (27,000 people on the mailing list), and fact sheets; attending the monthly "Sound Off" session in the Noise Abatement office; attending the quarterly Sea-Tac Noise Advisory (SNAC) committee meetings; and participating in committees formed for specific projects, such as the Part 150 Update. In addition, both Noise Abatement and Noise Remedy staff will and often do meet with individuals or groups on specific issues. A more detailed description is provided in Appendix D.

Evaluation Methodology: To evaluate effective public and information access methods the panel should consider diversity in opportunities, availability of staff, ease with which information is acquired, notification process for available opportunities, and timeliness and/or relevance of input methods.

Context Consideration 3

Do the noise reduction measures use all that is practically and reasonably available to the Airport?

In reviewing the Port's efforts to reduce and mitigate airport noise, the Panel should recognize the constraints under which Sea-Tac operates and the range of program elements that have been included in the Port's programs. The constraints under which Sea-Tac operates are both universal to major U.S. air carrier airports and unique to the region and to the agreements and procedures that have been established here. Given these constraints, however, the Port has maintained a wide variety of planning programs to reduce noise impacts that include extensive public participation.

- The Federal Government, primarily through the FAA, imposes an extensive series of controls that guide the operation of airports. These controls limit the airport's ability to modify aircraft activity; constrain the use of federal funds; and direct the planning, approval, and implementation of noise remedy and abatement programs. It is crucial, however, to work with the FAA to establish a measure of mutual understanding and cooperation.

- Due to open-access and interstate/international commerce considerations and because it is the primary airport for the region and the largest of several airports that serve the Pacific Northwest, Sea-Tac has a limited ability to limit or relocate operations in support of noise reduction. Additional blanket curfews or aircraft limitations are not realistically available to the Airport.

- Despite our efforts to maximize resources, the Port cannot accomplish all programs simultaneously. A logical set of priorities must be set to make use of available funds. Noise abatement and mitigation are continuing and evolving efforts. Demonstration projects are developed and used to ensure that full-scale programs will work and can be applied fairly to all. This decision-making process involves openness, education, and involvement.

Despite these constraints, there are several categories of noise reduction strategies available to airports. These are recognized strategies that are significant in reducing aircraft noise impacts. These strategies include land use planning and zoning, acquisition and insulation programs, and aircraft operational constraints. Sea-Tac has focused significant energy and resources to make progress in these areas.

Land use controls and zoning ordinances are recognized as important ways of controlling the impacts of airport noise on people. Through the Part 150 process and other planning efforts, Sea-Tac has worked with local and state jurisdictions in establishing land use policies and land use controls. The Port, in conjunction with the FAA and local jurisdictions, worked together to develop building codes that would incorporate sound attenuation requirements matching those set forth by the FAA and used by the Port of Seattle. Additional measures have been developed to encourage a closer working relationship among the Port and local communities. These include the establishment of a Planners Forum to discuss planning issues and the development of a process for access to federal funds to pay for city planning programs that result in plans compatible with FAA land use guidelines.

Beyond zoning and building restrictions, which are in the hands of local jurisdictions, airport acquisition of property is obviously the most effective method of reducing the number of people exposed to high noise impacts and assuring airport control of land use. Sound insulation programs provide noise mitigation for structures located in noncompatible noise zones. Based on FAA land use guidelines, effective sound insulation is the only way to reduce interior noise for some noncompatible land uses and make them compatible with the noise environment. As described elsewhere, the Port has active sound insulation programs for a variety of uses.

A variety of aircraft operational changes have the potential for reducing the impacts of aircraft operations. Many of these programs, however, simply move the noise from one area to another. Phasing-out the noisier aircraft can benefit everyone. To achieve a significant reduction in noise, the fleet mix of an airport needs to change. Through the use of a noise budget and nighttime limitations, Sea-Tac is aggressively pursuing the phase-out of the noisier aircraft. Since 1990, the proportion of Stage 3 operations has increased from 55 percent to 84 percent. Another method of addressing aircraft noise is the modification of flight tracks. Due to unalterable circumstances, such as location and orientation of the Airport, the complex airspace in the region, and the highly residential nature of the area, further flight track modifications would not have appreciable benefits. Track changes would simply move the noise around.

These points are important considerations for the Panel to evaluate as they decide whether Sea-Tac's reduction of noise impacts are meaningful. Airports operate in a very constrained and controlled environment. Sea-Tac has made important strides in addressing the range of airport noise impacts while operating within these constraints.

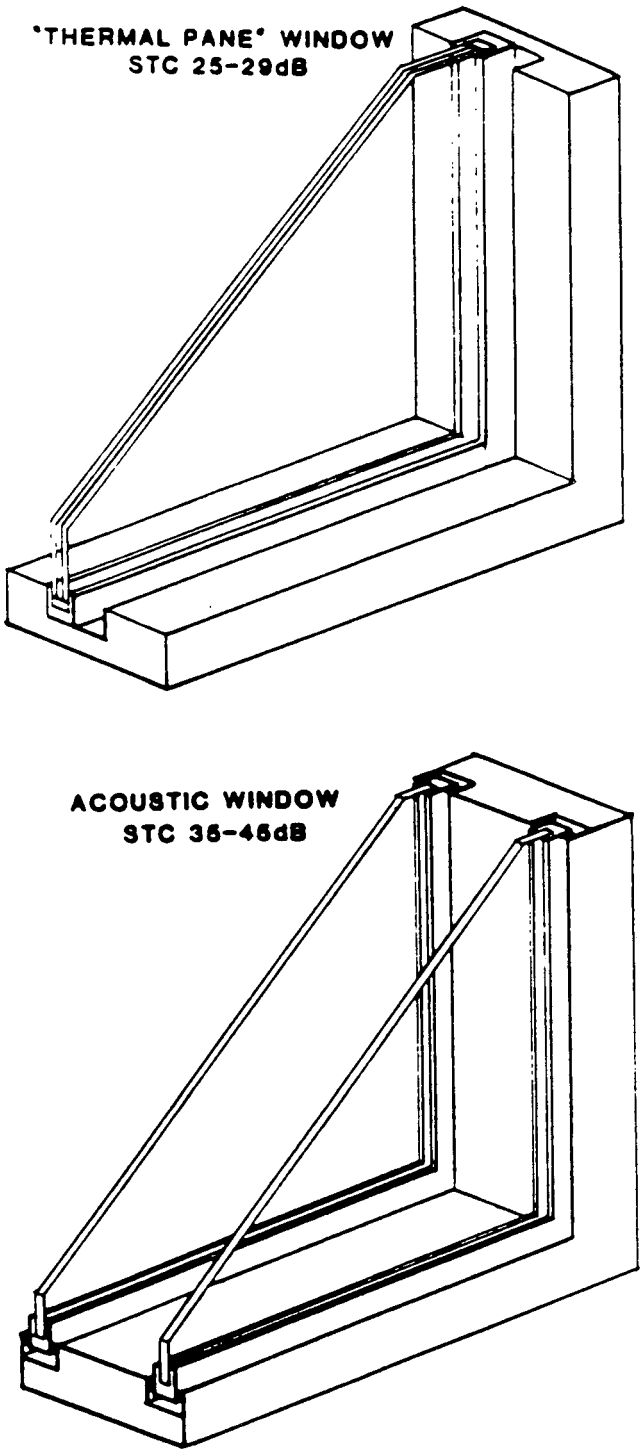


Figure 3. Operable-Sash Window Configurations.

wyle laboratories

20 dB to 29 dB). A few specially designed thermal pane products have attained STC (and EWR) ratings between 30 dB and 35 dB. The so-called "acoustic window" in Figure 3 has been found to be much more appropriate to aircraft noise reduction problems. It can have two different glazing panels (plate or laminated glass, or different thicknesses) separated by a 2 inch (or greater) airspace. This operable sash configuration has been tested to have STC (and EWR) ratings from about 40 dB to 48 dB depending on glass and frame details. The 40 dB to 44 dB range of this product is suitable for residential use whereas products with higher ratings exceed the depth of normal wood-frame wall construction.

Figure 4 shows the typical noise reduction (Transmission Loss) comparisons between these two configurations and that of the more traditional single-glazed configuration. As shown, the benefits of the 40 dB double window extend across the frequency spectrum, providing a Transmission Loss of the order of 30 dB at low frequencies compared to the order of 20 dB for single-glazed or thermal pane products. This 40 dB configuration, which is also used as a 44 dB STC unit with different thicknesses of glass, has been used in the Sea-Tac program since Phase 1. More recent trials of a dual glazed 35 dB STC unit and separately of a secondary window application (in the lower DNL noise zone) met with reduced benefit in NLR relative to the 40/44 dB units. Use of the latter configurations has therefore been continued into the most recent phases of the program.

The details of these noise reduction benefits for airport sound insulation were studied extensively in the 1969 and 1985 pilot projects around LAX airport, and in the 1987 Sea-Tac pilot project. All of the noise data acquired in these projects was in the form of interior and exterior analog recordings of aircraft noise with subsequent analysis in terms of frequency band and A-weighted Sound Levels. Figure 5 illustrates these benefits across the frequency spectrum by reference to measurements obtained in one of the Sea-Tac homes. While such measurements are highly susceptible to variation because of the fluctuating nature of aircraft noise and its spectral content, the general trend shown in this figure is consistent with that exhibited in other similar programs using the same sound insulation products. Subsequent successful programs at LAX, San Francisco, Orange County, Reno and Tucson airports and also at eastern U.S. airports have benefited greatly from these LAX and Sea-Tac investigations.

More recently, the Sea-Tac program has been innovative in the encouragement of other new product lines, such as locally produced vinyl frame windows and locally produced exterior doors.

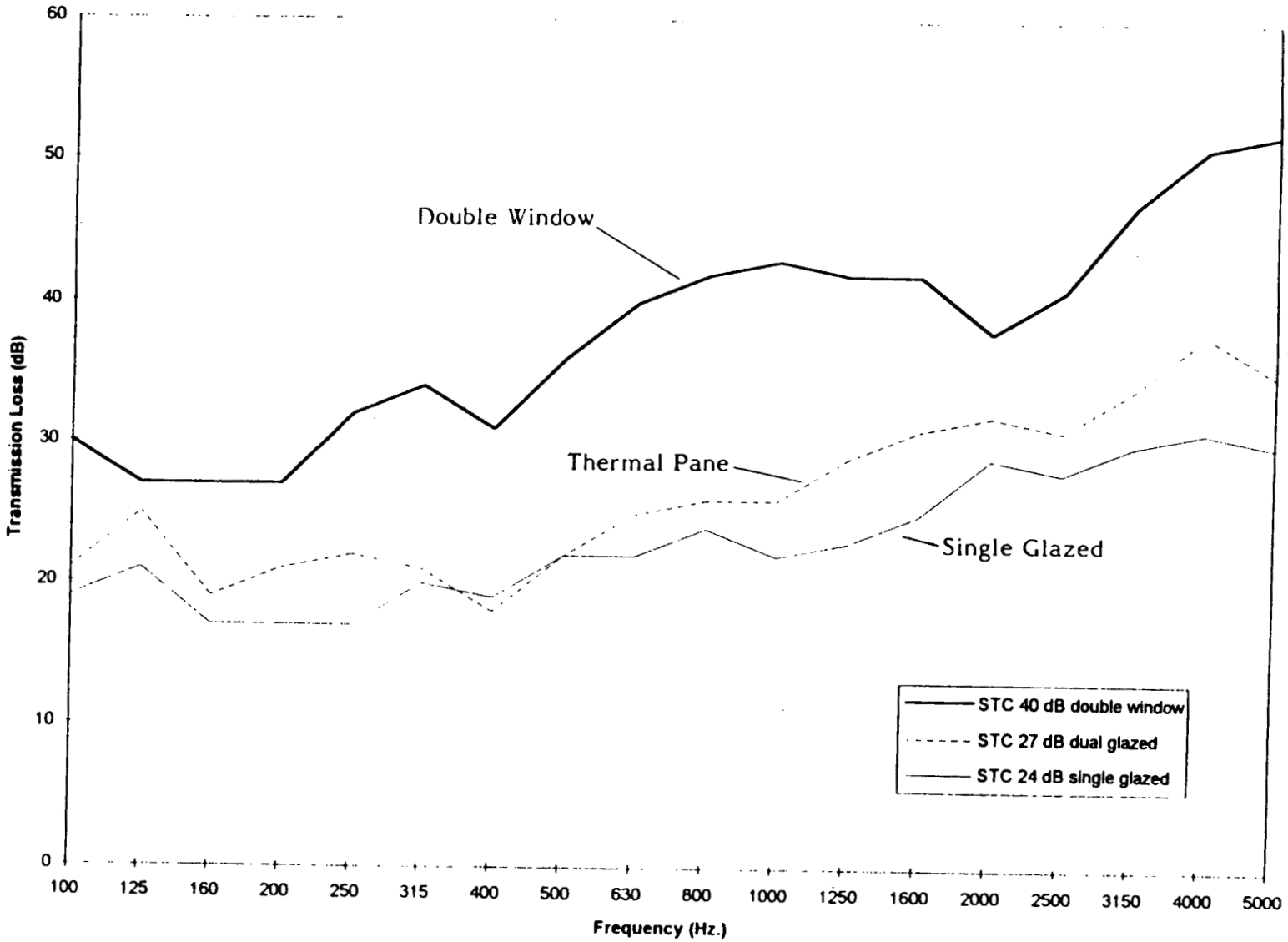


Figure 4. Comparison of Single and Dual Glazed Operable Window Transmission Loss with Acoustical Double Window Assembly.

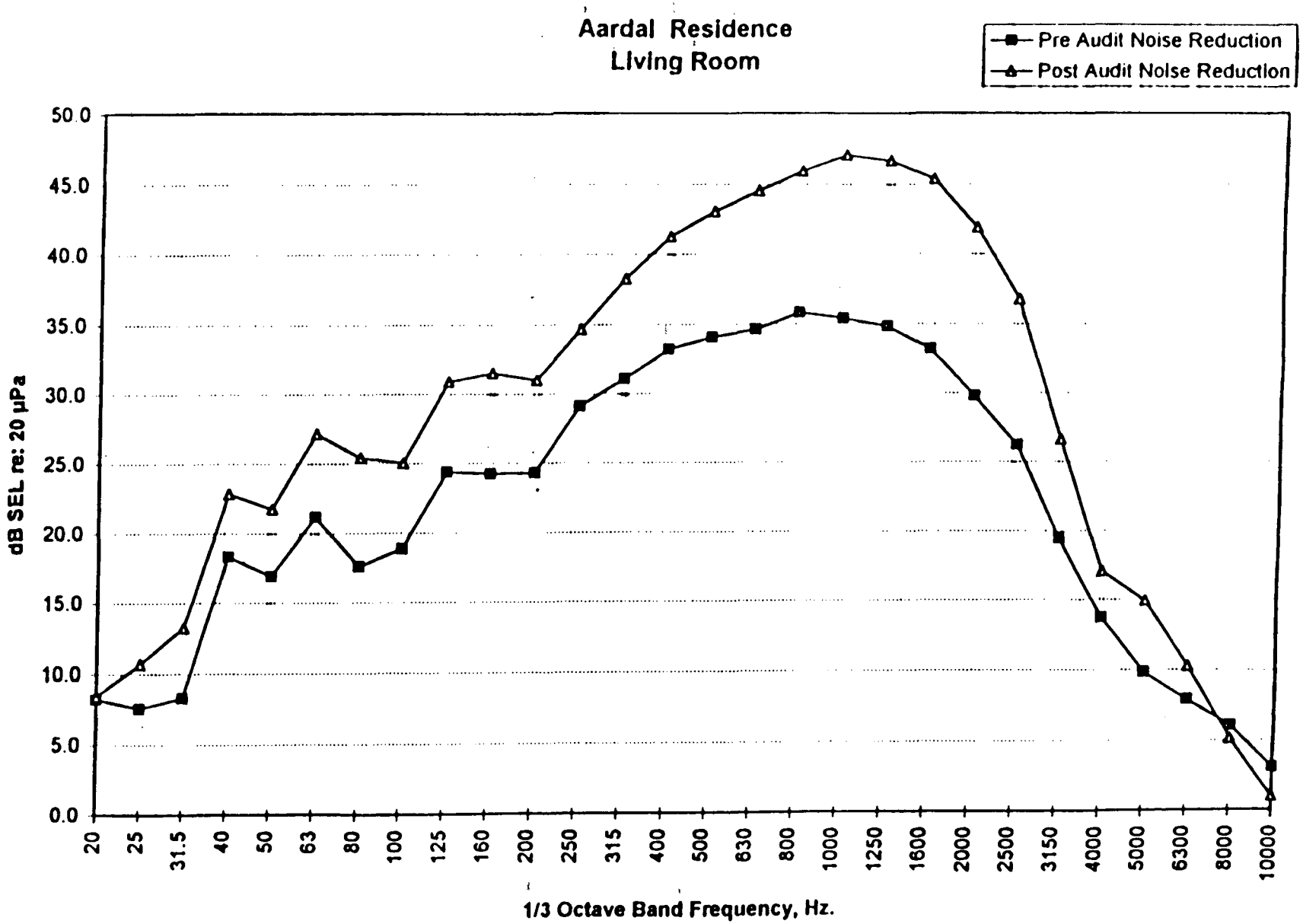


Figure 5. Spectral Content of Noise Reduction Before and After Sound Insulation.

One other area where the Sea-Tac program has generated an extensive bank of experience is that of secondary wall and roof applications. These are again a product of earlier pilot programs at LAX and Sea-Tac, but no other program in the U.S. has had such an extensive requirement for their implementation (especially in areas with DNL values in excess of 75 dB) as at Sea-Tac.

Figure 6 illustrates the basic concept of these applications which are used at Sea-Tac. The secondary wallboard is applied to the room interior wall or ceiling surface by means of resilient channels or a secondary stud frame. The benefits of these applications differ according to the type of pre- existing structure but typically will provide a 3 dB to 8 dB improvement, which can be critical to achieving overall noise reduction goals in excess of those given by window and door replacement alone.

One other application which can differ between "normal" and "aircraft noise" techniques is the extended use of thermal insulation materials (such as fiberglass or cellulose) to achieve high sound absorption coefficients at low frequencies (Figure 7). While the construction codes for thermal insulation around Sea-Tac already dictate the use of high R-value insulation materials in attic spaces, the low frequency noise benefits of these had already been implemented in the earlier pilot programs and included in the Sea-Tac program specifications.

In summary, while many of these sound insulation implementation techniques had been previously used for demonstration projects, the Sea-Tac program has been the most extensive proving ground for their large-scale usage and evaluation. Other programs have benefited greatly from the Sea-Tac experience, especially in gaining confidence that these types of programs can be rewarding both technically and for the community. These rewards at Sea-Tac are discussed further as follows.

3.4 Typical Results of Measurement and Opinion Surveys

As mentioned earlier, a continuous evaluation of the Sea-Tac program has been in progress since the 1986 pilot project. This has been by (a) noise reduction measurements (audits) before and after dwelling modification, and (b) opinion surveys (questionnaires) administered to residents after completion of the work in each house.

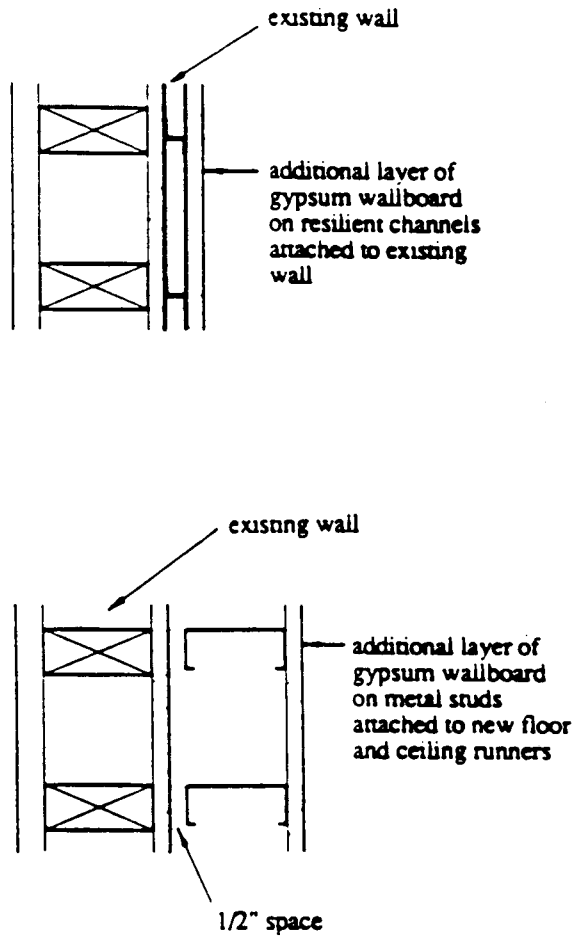
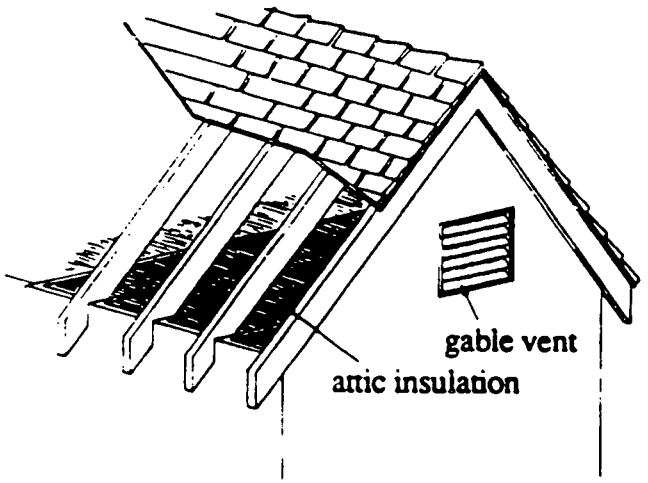


Figure 6. Example of Reducing Sound Transmission Through an Existing Wall (or Ceiling).



R-Value, Thickness, and Sound Absorption Coefficients for Fiberglass Batts

R-Value	Thickness (in.)	Sound Absorption Coefficient (in Octave Bands)				
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz
R-11	3.5	0.34	0.85	0.99	0.99	0.97
R-19	6	0.64	0.99	0.99	0.99	0.99
R-30	9	0.80	0.99	0.99	0.99	0.99

Material Thickness and R-Rating Comparison

Material	Required Thickness (in.)		
	R-11	R-19	R-30
Roll or Batt Fiberglass (one-sided Kraft paper)	3.5	6	9
Blown-in Fiberglass	5	8	13
Blown-in Rockwool	4	6.5	11
Blown-in Cellulose	3	4.75	7

Figure 7. Roof and Attic Insulation.

Audits

The noise reduction audits consist of simultaneous measurement of aircraft noise levels at the exterior and interior of a room during a number of takeoff events, and averaging the noise reduction values over those events. This same procedure has been tried, tested and approved in programs throughout the U.S. In earlier projects, particularly pilot projects, the noise level data would be recorded and analyzed in some detail.

However, this process is time-consuming and extremely expensive to apply to large-scale projects. Because of the need to economize in audits of continuous programs, and also because various reviews of audit procedures had confirmed its validity, the audit procedure of choice became that of using a fairly large array of programmable integrating sound level meters. The Port's noise remedy team acquired 13 such systems (Larson-Davis Model 700 Integrating Sound Level Meters) and has used these throughout the program, including scheduled maintenance and laboratory calibration (in addition to regular field calibration).

The noise remedy staff has maintained a continual review of the results of these audits to ensure that the goals of the program are being met. A summary report has been, or is being, prepared by the staff regarding these results. The following discussion is based on tabulations of data (prepared by the Port's staff) and discussions held with the staff on fairly regular basis over the past eight years.

The Port was initially required by the FAA to conduct audits on all participant dwellings to ensure their eligibility for grant funding. This requirement was subsequently reduced to a 25 percent sample, and more recently to a more manageable and cost-effective 10 percent sample for evaluation and quality assessments. Audit results are consequently available in summary form for some 440 homes of the 3238 homes completed so far. These results comprise audits of 2,236 different rooms, each having different acoustical characteristics and different noise reduction values both before and after their sound insulation.

A broad overview of these results indicates that the Sea-Tac program is consistently meeting its goals of achieving interior DNL values of 45 dB or less in post-modification audits. However, it must be said that about 38 percent of the audited rooms met this DNL requirement *before* modification. The latter statistic has been the subject of some discussion between the Port and the FAA at Sea-Tac, although other airport programs probably have similar statistics but are unconcerned about them. The simplest explanation is that all homes

are not equal (some are much better or poorer than the average) and all rooms are not equal (some being shielded from aircraft noise and some directly facing the flight paths). Of the 440 homes audited at Sea-Tac, the pre-modification interior data shows that:

- 27 percent (120 homes) had DNL values greater than 45 dB in all audited rooms,
- 64 percent (280 homes) had DNL values *less* than 45 dB in *some* rooms, and
- 9 percent (40 homes) had DNL values *less* than 45 dB in *all* rooms.

A total of 91 percent of these homes would therefore need sound insulation in some or all parts of the house. It was therefore questionable whether it was worthwhile to require a noise audit of *all* homes to identify and omit the 9 percent who might not be eligible. The FAA's AIP guidelines include the following statement:

> "Where noise attenuation is being proposed as a single project for a large number of structures, and where a standard package of noise attenuation improvement will be included, the 45 L_{dn} design objective for inhabited dwellings need not be so restrictively applied that it would result in an incidental number of homes within the project area receiving less than the standard package of improvements."

This has been taken by most program managers to indicate that an incidental number of exceptions may be included in a large-scale program. The 9 percent of exceptional structures at Sea-Tac can be considered incidental and therefore can receive the standard package of noise insulation. Similarly, since the 9 percent of homes are to be included, so might those rooms which are part of an otherwise eligible home. Assuming 5 rooms per home, a 10 percent compliance with the DNL 45 dB criterion in the 280 homes would result in a further 140 of the 2,236 audited rooms being soundproofed. This again does not appear to constitute a major burden or a need for a 100 percent audit to identify the exceptions.

It is therefore the case at Sea-Tac (and elsewhere) that some of the sound insulated rooms were better than 45 dB DNL prior to their modification. The fact that current statistics indicate that the quantity might be as high as 38 percent of all modified rooms is not necessarily a program default, considering the cost and time required for detailed surveying.

In further consideration of the audit results, it has also been of concern that some rooms do not meet the 5 dB improvement criterion. However, all of these are in cases where the pre-existing DNL value was lower than 45 dB. It is therefore the result of applying a standard package, which has been proven to give much more than 5 dB improvement to those

rooms or homes with the greatest need, to those with a much lesser need for improvement. In almost all of the programs being implemented throughout the U.S., the 5 dB minimum improvement is recognized as being appropriate to previously "deficient" rooms rather than all rooms in the program. The original intent of the 5 dB criterion was to ensure that lesser improvements (such as a 2 dB change from DNL 47 dB to 45 dB) would not be deliberately designed into a program. The fact that the 5 dB improvement does not necessarily occur in those rooms which started out with good sound insulation is therefore not a program deficiency.

While the foregoing discussion is intended as an overview of the Sea-Tac experience it does not explain all of the audited cases. Average improvements are of the order of 6.5 dB in 62 percent of all audited rooms and 4 dB in the other 38 percent. Some of these may be due to experimentation with different window and door products, including secondary (storm) windows and non-acoustically rated doors. These experimentations tend to be unique to the Sea-Tac program and consequently have helped other programs in decision making.

Opinion Surveys

An opinion survey questionnaire developed by Wyle Laboratories in 1985 was administered as part of the Sea-Tac pilot project in 1986. This has since been expanded and used for each of the continuing phases of the Program. The questionnaire is divided into the following sections:

- Homeowner Profile
- Noise Audit
- Scope of Work
- Solicitation of Bids
- Construction Process
- Inspections
- Effects of Insulation on Interior Noise Level
- Effects of Insulation on Appearance of Home
- Contractor Performance
- Referral
- Effects of Insulation on Home Value
- Overall (Opinion)

Of these, most are addressed to soliciting opinions on the processes involved in installing the insulation. One specific question category addresses noise reduction benefits by comparing pre-modification conditions and post-modification improvements to these conditions. These questions are shown in Figure 8 and are discussed below with regard to resident's responses.

These responses are tabulated from 470 questionnaires received from participating residents over the period January 1990 to June 1994. Responding to the opinion survey is purely voluntary and is not a condition of participation in the sound insulation program. The response rate is of the order of 35 percent of the total participation completed by June 1994. An updated summary of responses covering the period up to July 1995 is in preparation by the Noise Remedy Office.

Table 3 shows the number of responses to each activity listed in this question on the opinion survey:

> "Before the sound insulation was applied, how much difficulty, if any, did aircraft noise cause you (inside your home) in terms of: [various activities]"

Table 3

Tabulation of Resident Responses on Aircraft Noise Prior to Sound Insulation

Activity	*Very Much*	*Much*	*Some*	*Very Little*	*None*
Conversation	309	301	327	70	17
Speaking on the phone	450	261	229	66	14
Falling asleep *	64	65	151	66	16
Sleep Disturbance	207	194	338	188	71
Concentration	139	209	400	201	62
Relaxation	169	219	397	147	51
Listening to TV or radio	189	102	66	9	3

* Omitted from questionnaire after June 1994.
Note that not all respondees answered all questions.

EFFECTS OF INSULATION ON INTERIOR NOISE LEVEL

Before the sound insulation was applied, how much difficulty, if any, did aircraft noise cause you (inside your home) in terms of:

	Very Much	Much	Some	Very Little	None
Conversation	☐	☐	☐	☐	☐
Speaking on the telephone	☐	☐	☐	☐	☐
Falling asleep	☐	☐	☐	☐	☐
Sleep Disturbance (being awakened)	☐	☐	☐	☐	☐
Concentration (reading, studying, etc.)	☐	☐	☐	☐	☐
Relaxation	☐	☐	☐	☐	☐
Listening to TV or radio	☐	☐	☐	☐	☐

Other (Please specify)_____

Since the sound insulation was applied, how would you describe the changes to the living environment (inside insulated rooms) in terms of:

	Much Improved	Improved	Slightly Improved	No Change	Worse
Conversation	☐	☐	☐	☐	☐
Speaking on the telephone	☐	☐	☐	☐	☐
Falling asleep	☐	☐	☐	☐	☐
Sleep Disturbance (being awakened)	☐	☐	☐	☐	☐
Concentration (reading, studying, etc.)	☐	☐	☐	☐	☐
Relaxation	☐	☐	☐	☐	☐
Listening to TV or radio	☐	☐	☐	☐	☐

Other (Please specify)_____

Figure 8. Opinion Survey Questionnaire: Effects of Insulation on Interior Noise Level.

From the responses to this question, it is apparent that the most severe problems inside the homes were perceived to be in speech intelligibility (conversation, speaking the phone, listening to TV or radio) which elicited responses of "much" or "very much" difficulty from about 67% of the respondees (conversation 60%, telephone 70% and TV/radio 79%). Sleep effects (falling asleep, disturbance) elicited responses of "much" or very much" difficulty from about 38% of the respondees (falling asleep 27%, disturbance 40%). Responses for relaxation (39%) and concentration (34%) were the lowest among the concerns.

The follow-up question regarding the benefits of sound insulation, is as follows:

"Since the sound insulation was applied, how would you describe the changes to the living environment (inside insulated rooms) in terms of: [various activities]"

The response to this question are tabulated in Table 4 with regard to the number of people indicating one of a range of answers (much improved, improved, slightly improved, no change, or worse) to each topic.

Table 4

Tabulation of Resident Responses on Changes Since Sound Insulation

Activity	*Much Improved*	*Improved*	*Slight Improvement*	*No Change*	*Worse*
Conversation	426	499	37	44	9
Speaking on the phone	454	358	121	47	8
Falling asleep	330	356	121	144	7
Sleep Disturbance	339	356	135	162	9
Concentration	325	395	153	117	9
Relaxation	315	383	152	101	11
Listening to TV or radio	451	379	114	46	6

Note that not all respondees answered all questions.

As might be expected from the response to the previous question, the responses regarding improvements attributable to sound insulation are again concentrated on speech intelligibility issues with the percentages of "much improved" or "improved" responses being:

- conversation 91%
- phone usage 80%
- TV or radio 83%

Effects of the sound insulation on sleep were noted to be "much improved" or "improved" as follows:

- falling asleep 72%
- sleep disturbance 69%

Other effects were rated "much improved" or "improved" as follows:

- Concentration 72%
- Relaxation 73%

It could therefore be concluded that the perceived benefits of sound insulation are consistent with the perceived problems of aircraft noise in that they give the most benefit where there is most difficulty.

These Sea-Tac program results are highly consistent with those at other airports where the same questions have been posed. This is especially true with the order of relative priorities and benefits, speech intelligibility being the consistently leading problem and being the most improved by sound insulation applications.

In two other supplementary questions to the participating residents, their responses to: "Would you recommend this program to your neighbors?" was 98% affirmative, and to "In retrospect, do you feel that installing the sound insulation was a good idea or not?" was 91% affirmative.

These responses would indicate that the Sea-Tac program is providing an appropriate and worthwhile benefit to the participant population.

This information is provided by the Port of Seattle to the Expert Panel in response to their request for information about the accoustical insulation program made at the May hearings.

INSULATION DATA COLUMNS

A. AIP grant number

B. Years insulation performed

C. Goals - Houses - All rooms over 45 DNL

D. Some rooms over 45 DNL and some rooms equal or under 45 DNL

E. All rooms equal to or under 45 DNL

F. Rooms > 45 DNL

G. Average Reduction before insulation

H. Average DNL before insulation

I. Equal to or less than 45 DNL

J. Average Reduction before insulation

K. Average DNL before insulation

L. Results - Rooms previously over 45 DNL - Average reduction after insulation

M. Average DNL after insulation

N. Standard deviation

O. 90% Confidence interval

P. Results - Rooms previously equal or under 45 DNL - Avg reduction after insulation

Q. Average DNL after insulation

R. Standard deviation

S. 90% Confidence interval

PRESENTATION OF INSULATION DATA

					Prior to Insulation						After Insulation							
AIP/Years			Houses		Rooms>45 DNL			Rooms</=45 DNL			Rooms>45 Prior				Rooms</=45Prior			
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
9	85-91	10	38	1	107	26.2	48.7	66	32.1	41.4	31.5	43.3	2.7	0.7	34.7	37.8	4.5	1.9
13	88-91	9	43	3	196	27.1	48.6	100	31.7	42.5	34.1	41.6	5.1	0.7	35.2	39	5.1	0.9
17	88-93	12	44	1	254	27.3	48.8	60	32.2	41.8	34.8	41.6	4.2	0.5	37.3	38	5.6	2.9
22	89-93	57	17	2	298	27.4	48.5	74	31.9	41.7	34.4	41.5	5.8	0.6	34.7	39	3.6	0.7
29	91-94	6	57	8	174	25.9	48.3	227	32	40.6	31.8	42.5	3.6	0.5	37.6	35.2	4.1	0.5
31	91-93	8	20	7	105	26.3	48.6	90	31.4	41.4	32.7	42.5	3.5	0.6	35	37.6	3.2	0.6
32	91-95	5	31	6	108	26.1	49.1	107	31.8	41.4	32.4	43.1	3.1	0.5	35.4	37.8	3.3	0.5
36	93-95	7	20	8	91	26	48.7	83	30.8	41.3	32.5	42.2	4.5	0.8	34.7	37.4	3.3	0.6
38	93-95	1	3	0	16	27.6	47.6	3	31.4	42	33.1	42	3.5	1.4	30	43.3	2.1	1.7
42	94-95	4	5	4	30	25.9	51.5	31	29.8	40.7	32.3	42.4	4.1	1.2	33.1	39.9	2.8	0.8
99	92-95	1	2	0	12	27	48.9	4	31.8	43.6	33.7	42.2	1.9	0.9	35.4	40	2.9	2.4
ALL YEARS		**120**	**280**	**40**	**1391**	**26.8**	**48.6**	**845**	**31.8**	**41.4**	**33.4**	**42.1**	**4.3**	**0.6**	**35.9**	**37.3**	**4.0**	**0.9**
		TOTALS				**WTD.AVGS.**		**TOTAL**	**WEIGHTED AVERAGES**									

Notes:
1. 99 represents miscellaneous non-AIP projects
2. Large figures in the confidence column reflect the size of the sample.
3. Totals include only those houses/rooms that received post audits.

Bibliography

Bibliography

EPA (Environmental Protection Agency). (1974). *Information on Levels of Environmental Noise Requiste to Protect Public Health and Wealfare with an Adequate Margin of Safety*, March 1994.

FICON (Federal Interagency Committee on Noise). (1992). *Federal Agency Review of Selected Airport Noise Analysis Issues.* August, 1992.

Fidell, S., Silvati, L. and Pearsons, K. (1995). *Social survey of community response to noise exposure near Seattle-Tacoma International Airport.* Bolt Beranek and Newman Technical Report Number 8070, BBN Systems and Technologies, Canoga Park, CA, USA.

Fidell, S., Pearsons, K., Howe, R., Tabachnik, B., Silvati, L. and Barber, D.S. (1994). Noise-induced sleep disturbance in residential settings. *Final Report to the Air Force Materiel Command.* Wright-Patterson Air Force Base, Ohio, USA.

Fidell, S., Schultz, T.J., & Green, D.M. (1988). A theoretical interpretation of the prevalence rate of noise-induced annoyance in residential populations. *Journal of the Acoustical Society of America, 84*, 2109-2113.

Fidell, S. & Silvati, L. (1989). An assessment of the effect of residential acoustic insulation on the prevalence of noise induced annoyance in an airport community. *Prepared for Office of the City Attorney,* Long Beach, CA by BBN Systems and Technologies Corporation.

Fields, J.M. (1993). Effect of personal and situational variables on noise annoyance in residential areas. *Journal of the Acoustical Society of America, 93*, 2753-2763.

Fields, J.M. (1992). Effect of personal and situational variables on noise annoyance: With special reference to implications for en route noise. Report to NASA Langley Research Center and FAA.

Finegold, L.S., Harris, C.S., & Von Gierke, H.E. (1992). Applied acoustical report: Criteria for assessment of noise impacts on people. Cited in FICON, 1992.

Green, D.M. & Fidell, S. (1991). Variability in the criterion for reporting annoyance in community noise surveys. *Journal of the Acoustical Society of America, 89*, 234-243.

Hall, F.L. (1984). Community response to noise: Is all noise the same? *Journal of the Acoustical Society of America, 76*, 1161-1168.

Hall, F.L., Birnie, S.E., Taylor, S.M. & Palmer, J.E. (1981). Direct comparision of community response to road traffic noise and to aircraft noise. *Journal of the Acoustical Society of America, 70*, 1690-1698.

Hall, F.L., Taylor, S.M. & Birnie, S.E. (1980). Spatial patterns in community response to aircraft noise associated with non-noise factors. *Journal of Sound and Vibration, 71*, 361-381.

Hall, F.L., Taylor, S.M. & Birnie, S.E. (1985). Activity interference and noise annoyance. *Journal of Sound and Vibration, 103*, 237-252.

Horonjeff, R.D., Fidell, S., Teffeteller, S.R. & Green, D.M. (1982). Behavioral awakening as functions of duration and detectability of noise intrusions in the home. *Journal of Sound and Vibration, 84*, 327-336.

Job, R.F.S. (1988). Community response to noise: A review of factors influencing the relationship between noise exposure and reaction. *Journal of the Acoustical Society of America, 83*, 991-1001.

Kryter, K.D. (1985). *The Effects of Noise on Man.* Second Edition. Orlando, FLA: Academic Press.

Miller, N.P., Von Gierke H.E., Eldred, K., "Impact Assessment Guidelines for the Effects of Noise on People", *Prepared for Transport Canada*, HMMH, Report # 291060.01, March 1991.

Ollerhead, J.B., Jones, C.J., Cadoux, R.E., Woodley, A., Atkinson, B.J., Horne, J.A., Pankhurst, F., Reyner, L., Hume, K.I., Van, F., Watson, A., Diamond, I.D., Egger, P., Holmes, D., & McKean, J. (1992). *Report of a Field Study of Aircraft Noise and Sleep Disturbance.* Department of Transport, Civil Aviation Authority, Great Britain.

Rylander, R., Bjorkman, M., Ahrlin, U., Sorensen, S. & Berglund, K. (1980). Aircraft noise annoyance contours: Importance of overflight frequency and noise level. *Journal of Sound and Vibration, 69*, 583-595.

Schultz, T.J. (1978). Synthesis of social surveys on noise annoyance. *Journal of the Acoustical Society of America, 64*, 377-405.

Taylor, S.M. (1982). A comparison of models to predict annoyance reactions to noise from mixed sources. *Journal of Sound and Vibration, 81*, 123-138.

Taylor, S.M. (1984). A path model of aircraft noise annoyance. *Journal of Sound and Vibration*, *96*, 243-260.

Taylor, S.M., Hall, F.L. & Birnie, S.E. (1980). Effects of background levels on community responses to aircraft noise. *Journal of Sound and Vibration*, *71*, 361-381.

Taylor, S.M., Hall, F.L. & Birnie, S.E. (1981). A comparison of community response to aircraft noise at Toronto International and Oshawa Municipal Airports. *Journal of Sound and Vibration*, *77*, 233-244.

WHO Task Group on Environmental Health Criteria for Noise. (1980). *Environmental Health Criteria 12: Noise*. Geneva: World Health Organization.

Appendix A

PORT 0003359

APPENDIX A

PORT OF SEATTLE
SEA-TAC AIRPORT NOISE INSULATION PROGRAM

wyle laboratories

REPORT

WYLE RESEARCH REPORT
WR 95-36

REVIEW AND DISCUSSION OF THE PORT OF SEATTLE SOUND INSULATION PROGRAM IN THE VICINITY OF SEA-TAC AIRPORT

Prepared for:

Sea-Tac International Airport
P.O. Box 68727
Seattle, WA 98168-0727

Attention:

Diane Summerhays

Prepared by:

Wyle Research
128 Maryland Street
El Segundo, CA 90245

J/N 39625-01

September 1995

FOREWORD

This document has been prepared by Wyle Research under contract to the Port of Seattle. The principal author is David Brown, manager and senior acoustical consultant of Wyle's research staff in California. Mr. Brown and other Wyle staff members have been engaged as sound insulation design consultants on more than 24 projects at seven separate airports in the western region, during the period 1983 to the present. Wyle was also the design and research consultant for the 1969 and 1983 pilot projects in the area of Los Angeles International Airport and for the 1985 pilot project at Seattle-Tacoma International Airport.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The Port of Seattle initiated a residential sound insulation program around Sea-Tac Airport in 1985 using an Airport Improvement Program (AIP) grant of federal funding amounting to 80 percent of eligible costs, the remainder being funded by the Port. In Phase 1 of the program, 21 dwellings were sound insulated for demonstration purposes, tested for their Noise Level Reduction (NRL) improvements and qualitatively assessed by their occupants via an opinion survey questionnaire. Since it was subsequently considered in 1987 that the demonstration project was highly successful in mitigating the effects of aircraft noise intrusion within the homes, it was decided by the Port to continue the program into further phases.

As of September 1995, a total of 3350 homes have been sound insulated in the program. Sampling of the homes for Noise Level Reduction improvements has shown that the program continues to provide notable benefits to the participant residents. Changes in program content have occasionally been attempted to maintain or increase the NLR improvements at reduced cost or with locally produced products and materials.

Opinion surveys, continued throughout the program for purposes of maintaining an oversight of participant satisfaction, have generally shown a high (average) degree of perceived benefit of the program, while local variations in perceived benefit relate directly to changes in the design including attempted introduction of different window assemblies.

Regarding the methodology used to implement the program at Sea-Tac, this has been innovative in both its technical and organizational aspects to the extent that it is a model of achievement which has received wide national and international attention and emulation. Its technical aspects are based on well-founded engineering practice with a deliberate and distinct application for aircraft noise mitigation purposes. The organizational aspects are unique in their use of computer technology to enhance the accuracy, consistency and efficiency of sound insulation design for a wide range of housing construction types and different noise exposures.

This report provides a review of the program's purpose, objectives and results in relation to those at other airports in the U.S. and with reference to surveys of measured and perceived (opinion) benefits.

2.0 *AIRPORT SOUND INSULATION PROGRAMS*

2.1 *Purpose and Objectives*

One of the first attempts (in the U.S.) at performing remedial sound insulation of existing homes near an airport was a pilot study near Los Angeles International Airport (LAX) in 1969. It was found at that time that while suitable products and materials (e.g., special windows and doors, etc.) were available on the market to provide significant improvements to the reduction of aircraft noise intrusion into homes, the costs of implementing a large-scale program would be prohibitive. In addition, because of the exceedingly high levels of aircraft noise at that time, the interior noise levels in most homes would still be unacceptable to the residents. Thus the purpose of providing noise mitigation would not be achieved in such circumstances.

In 1983, pending the release of a FAR Part 150 study for LAX, the airport sponsored a further examination of the potential benefits of residential sound insulation. This was primarily a paper study which (a) re-examined available products, (b) recalculated the potential noise reductions using a larger data base of information on existing aircraft noise and existing housing stock, and (c) re-evaluated potential program costs and benefits. This 1983 study concluded that the benefits could be significant, of the order of 5 dB to 15 dB improvement in noise reduction, depending on the extent of the remedial work. It was also concluded that the resulting interior noise levels would be of a much less objectionable magnitude than those of the earlier 1969 project, due to decreases in jet aircraft noise and changes in the frequency spectral content of aircraft noise since 1969. The 1983 study also developed a set of generalized specifications which could be applied to homes in the 65-70 dB, 70-75 dB and greater than 75 dB CNEL (similar to DNL) noise exposure areas respectively, around the airport.

A follow-on demonstration project applied the generalized specifications to 20 occupied dwellings around LAX. These homes were surveyed in 1985 to determine the resulting noise level benefits, the residents' perception of the sound insulation, and the costs associated with the implementation. A similar pilot program was also in progress on 21 dwellings at Sea-Tac airport using the same sound insulation methods as those used at LAX.

As a result of these two pilot programs, the main purpose and objectives of sound insulation programs were developed for subsequent use at LAX, SEA and other airports.

The purpose of the programs became clear; namely, to achieve a sufficient improvement in interior noise levels that many of the pre-existing noise problems were alleviated. Opinion surveys clearly showed that speech interference (listening to TV/radio, use of telephone, conversation) was of major importance and could be alleviated to provide a much more livable environment within the homes.In terms of technical objectives, the only pre-existing guideline was to achieve an interior DNL not greater than 45 dB. However, in both the LAX and Sea-Tac pilot programs it was shown that this interior DNL condition was already achievable in many of the homes simply by closing all windows and doors.

In reviewing the LAX pilot project opinion survey results (while the Sea-Tac project was still in progress) it became evident that most homeowners considered their modified conditions to be "much" or "very much" improved relative to the pre-modification conditions. Some residents were sufficiently impressed with the new conditions that they moved televisions and/or phones into rooms which had previously been too noisy for such use. Because of this, the study extended its investigation to address the subject of single-event noise levels within the various rooms in the homes. While the results of that investigation were not documented in the LAX reports (because the State noise standards referred only to CNEL levels), they became part of a recommendation to the Sea-Tac program.

These DNL (CNEL and single event design criteria were subsequently applied in follow-up projects at LAX and Sea-Tac and in initial phases of programs of the cities of San Bruno and Millbrae (near San Francisco Airport, SFO) which were among the earliest projects funded through the FAR Part 150 AIP grant process in the late 1980's. The Federal Aviation Administration (FAA) subsequently adopted the 5 dB improvement goal as part of its guidelines, but rejected the use of single-event noise levels as a supplementary criterion.

The remaining objectives are therefore to achieve,

- an interior DNL (or CNEL) of not more than 45 dB, and
- an improvement of at least 5 dB in major rooms (where economically feasible).

Regarding economics, most programs will accept feasibility to be based on the replacement of windows and exterior doors, but not include modifications to walls or roof structures unless necessary to meet the 45 dB DNL criterion. In the San Francisco area, none of the programs (by San Bruno, Millbrae, Daly City, South San Francisco, Pacifica or San Mateo County) include a mechanical air circulation (ventilation) system as part of the design, the original consideration being that it was an unnecessary cost to the program.

2.2 *Typical Results and Costs*

The results of some recent projects conducted in the western states are shown in Table 1 as averages in pre-and post-modification noise level reduction and Noise Level Reduction (NLR) improvement. All of the programs achieved an interior DNL of 45 dB in all eligible rooms with the exception of about 20 percent of kitchens and some family room additions which have lightweight walls and/or open beam, flat roofs. Where dwellings have flat roofing in an otherwise substantial structure such as in Tucson, Arizona, an exterior roofing is added to achieve the project goals.

Table 1

Example Achievements in Noise Level Reduction
for Single Family Dwellings in Various Airport Programs
(Averaged Over Surveyed Rooms)

Project	Airport	Pre-Mod	Post-Mod	Improvement	Number of Dwellings	Average Cost per Dwelling
San Bruno 1	SFO	25.3	31.8	6.5	48	11,027
San Bruno 2	SFO	22.3	34.6	10.6	38	14,012
San Bruno 3	SFO	*	34.7	–	81	11,690
Millbrae 1	SFO	29.9	36.2	6.2	66	9,700
Millbrae 2	SFO	26.4	33.0	6.6	103	9,600
San Mateo	SFO	28.3	33.9	5.6	35	14,165
Ontario	ONT	25.0	31.8	6.8	80	19,975
Tucson	TUS	27.7	36.2	8.5	19	14,266
Seattle	SEA	28.7	34.3	5.6	3350	13,000

Notes: * Not measured
- Programs at SFO exclude ventilation systems.
- Ontario costs include full air conditioning.

All of the results in Table 1 are for AIP funded projects. They exclude pilot programs in which extra costs were incurred for non-standard items and other programs where homes

were unusually large or unique. The typical floor area of the dwellings included in Table 1 (exclusive of Seattle) is of the order of 850 to 950 square feet. Seattle dwellings are typically of the order of 1500 sq. ft in floor area.

As can be seen in the tabulated data, the general trend is that project homes with the worst (lowest) pre-existing sound insulation values tend to have the best (highest) level of improvement after modification. It is also evident that the typical post-modification NLR value is of the order of 34 dB (averaging 33.7 dB over the sample).

In these respects the various programs at SFO, ONT, TUS and Sea-Tac airports are quite similar in achievements, in that the end result provides an NLR compatible with interior DNL values of less than 45 dB.

2.3 *Typical Rates of Implementation*

The only continuous running series of programs in the western states other than the Sea-Tac program is at San Francisco International Airport and comprises phased projects at six separate communities. The average rate per year over a 10 year period is very low, of the order of 130 homes per year if the earliest project is omitted. This has been due to delays in getting fully organized, problems with contractors and a total reliance on the supply of grants by FAA, which have averaged an annual total of $2.5 million between 1986 and 1993 for the SFO area.

More recent projects in the SFO area have attempted to increase productivity by increasing the number of dwellings in each construction bid package. Some recent packages have included as many as 450 homes in one bid package. These larger phases are ongoing at present and include about 900 homes in the design or implementation stages.

By contrast, the Sea-Tac program has completed 3,350 dwellings since 1985, as is subsequently discussed.

3.0 THE SEA-TAC PROGRAM

3.1 Overview

The Port of Seattle's program of residential sound insulation was introduced as part of the airport's noise remedy program in 1985. After a pilot project on 21 dwellings of varied construction and noise exposure (from a DNL of 65 dB to a DNL of 79 dB based on the then-current airport noise contours), a program team was organized to implement the program on a continuous basis. Participation by homeowners is voluntary and requires the signing of an avigation easement and an agreement regarding maintenance and upkeep of installed products. Funding comprises Federal AIP grants (80 percent) and non-Federal Port Authority grants (20 percent) or PFC funding of full or partial costs.

The Federal grant funds can only be applied to program elements which comply with the AIP eligibility criteria. Because the Port seeks to maintain its eligibility for federal funds, the eligibility criteria limit the Port in its goals and applications to those directed by the Federal Aviation Administration. However, the Port did not make its program totally contingent on the receipt of AIP grants and has therefore incorporated some innovative approaches into its continuing program.

The initial progress during the first few years of the program was steady, rising to an implementation rate of about 30 homes per month entering (and leaving) the program by mid-1993. However, in November 1992 the Port Commission issued a mandate to increase the insulation rate so that the program would be completed by 2001. Specific insulation targets were given that related to a proposed third runway. For example, up to 5,000 homes must be offered insulation before construction of the proposed runway could begin. As a result of this commission directive, the implementation rate rose to over 100 homes per month in early 1994. The result is that while a total of 1,050 dwellings had been sound insulated at Sea-Tac by June 1993, this total has increased to 3,350 completed dwellings by the end of September 1995, with a current implementation rate of over 100 homes per month. This accelerated program has been made possible by (a) continuing Federal grant offers amounting to a total of $53.6 million since program inception through current grants, and (b) innovations in program implementation by the Noise Remedy Office staff which include changes to methods of creating work specifications for each dwelling. The latter aspect has generated considerable interest at other airport sound insulation programs throughout the U.S. and may be emulated in some of those and at some foreign airports (such as at Sydney, Australia). The design and technical aspects of the program are discussed later in this section

of the report. This program implementation change has, among other things, greatly decreased the administrative expense, therefore allowing more dollars to be spent on actual construction.

Administration of the Seattle program is by a Port staff team currently comprising 20 full-time staff members in a field office (ex-school building) in the project area. The Seattle program is unusual in that some of the project management functions are performed by the participating homeowner(s) for each dwelling, including obtaining contractor bids from at least three contractors from a pre-approved listing, and subsequently scheduling the work with the contractors. The Port remains the contracting agency and conducts inspections of the work and is responsible for quality controls and contractor payments.

The objectives of the Seattle program are essentially identical to programs at other airports. The design criteria are to reduce interior noise from aircraft to at or below DNL 45 dB and obtain a noise reduction improvement of at least 5 dB. It has sometimes been found that meeting both criteria is difficult or potentially excessive in costs and real needs. For example, one or more rooms in a dwelling may have pre-existing NLR values in excess of 35 dB and improvement by a further 5 dB would require significant modifications to walls and ceilings which are costly and not a priority in terms of benefits. In such a case, the application of the standard remedies, such as window replacement, may not yield a 5 dB increase. In cases where both goals were not met, one of them would be met. Both goals have been met in most cases and essentially all homes have registered an improvement in exterior-to-interior noise level reduction.

The achievements of the program are continuously evaluated by conducting pre- and post-construction noise audits (noise measurement surveys) and by administering a homeowner opinion survey (questionnaire) after completion of the work on each home. Initially the noise audits were performed on every participating dwelling, first to determine eligibility for sound insulation and second to demonstrate achievements. This was reduced to about 25 percent of the dwellings in 1990 in order to increase participation without increasing staff workloads and non-construction cost factors, and was further reduced to 10 percent in 1994. In essence, the reduction to a 10 percent sample rate for audits is approved and accepted by the FAA as an adequate proof of performance and quality control.

The average construction cost per dwelling has been $13,000. This was a combination of higher costs ($18,000 average) in a higher noise region and lower costs ($8,000 average) in a lower noise region within the DNL 65 dB contour. The higher noise region is denoted as

eligible for a custom-designed sound insulation (in most cases this would include replacement windows, wall and ceiling treatments) and/or transaction assistance program. The lower noise region is designated a Standard Sound Insulation Program area. This area comprises 7,000 homes which are eligible for a less complicated sound insulation package. Originally, this involved secondary windows rather than replacement windows, plus other standard features such as doors, attic insulation and ventilation systems. The secondary window approach has since been abandoned because of homeowner dissatisfaction and the variability of noise reduction improvements. Consequently the cost per dwelling in the standard insulation area is approaching that of the neighborhood reinforcement area.

3.2 Technical Methodology

The design methodology used by the Port staff evolved from studies conducted by Wyle Laboratories in earlier years as part of research efforts on improvements to the sound insulation of buildings around highways and airports. These studies were carried out for the U.S. Department of Housing and Urban Development (HUD); the U.S. Environmental Protection Agency (EPA), and the Federal Aviation Administration (FAA). It was immediately recognized in these studies that the characteristics of highway and aircraft noise were distinctly different from each other and from the type of noise for which most building codes and product evaluations (such as Sound Transmission Class, STC) were intended. The studies therefore gave particular attention to the nature of transportation noise problems and specifically to the transient single-event and low frequency dominant characteristics of aircraft noise near airports. It was also clear that traditional methods of conducting sound insulation calculations, in terms of frequency band analysis, would be extremely burdensome. The calculations would have to take into consideration all of the different single-event noise conditions, all the different construction types, and the different room acoustics that would need to be addressed. After considerable examination of many options, Wyle's resulting approach was to create a comprehensive computer program. This program would have a well-founded data base of noise reduction values for most of the types of construction elements (windows, doors, walls, roofs, etc.) which are important to an airport sound insulation program, including pre-existing and replacement or remedial elements. These data were to be obtained by reference to laboratory test results obtained by the National Bureau of Standards for its NBS Building Science series, by Wyle Laboratories in various sound insulation projects, and by the manufacturers of windows and doors for purposes of establishing STC ratings for their products in accordance with American Society for Testing and Materials (ASTM) standards.

One of the key changes in this methodology was the development of a different single valued classification index (instead of STC) that would be applicable for aircraft noise and would reduce the time-consuming frequency band analysis to a more manageable, but sufficiently accurate, calculation procedure. The resulting classification index, the Exterior Wall Rating (EWR), gives added importance to the transmission loss at low frequencies and less importance to higher frequency values as illustrated in Figure 1.

The computer program was extensively tested for a wide range of conditions around LAX in a 1985 pilot project on 20 homes, and was supplied to the Port of Seattle as part of the Sea-Tac pilot program deliverables in 1987. The data base comprised EWR values derived from all of the frequency band transmission loss test results compiled in the earlier studies, and an extensive data base of cost factors appropriate to each remedial item (such as secondary or replacement doors, windows, wall modifications, etc.)

The program uses standard acoustical theory for the calculation of exterior-to-interior noise reduction of an enclosure (room) with corrections for the type of source (aircraft, highway noise, or other), the type of room (depending on interior furnishings and sound absorption), and the respective surface area of each element of each exterior facade. The noise reduction calculation is performed for each room in its pre-existing condition and subsequently for a menu-selected or cost-minimized package of remedies which will meet the required goal (interior DNL or DNL improvement). The design of sound insulation improvements is therefore standardized. The program can be used by project staff without acoustical engineering training or experience.

The Port of Seattle noise remedy staff quickly adapted to the use of this computer program for residential sound insulation design and, allowing for various upgrades for new products or increased cost factors, used this method as its design standard for the first seven years (1987 through 1993) of the continuous Sea-Tac residential sound insulation program. The computer program has since been validated in other projects using hundreds of different rooms as test cases where pre-modification and post-modification noise reductions were measured.

Through long-term use of the computer program, the Sea-Tac program staff became very knowledgeable in the noise reduction benefits of various remedial products and their combined use in design packages. Coincidentally, the need for an increased rate of implementation by the beginning of 1994 required that the design process be re-examined since it had become the primary labor-intensive and time-consuming constraint.

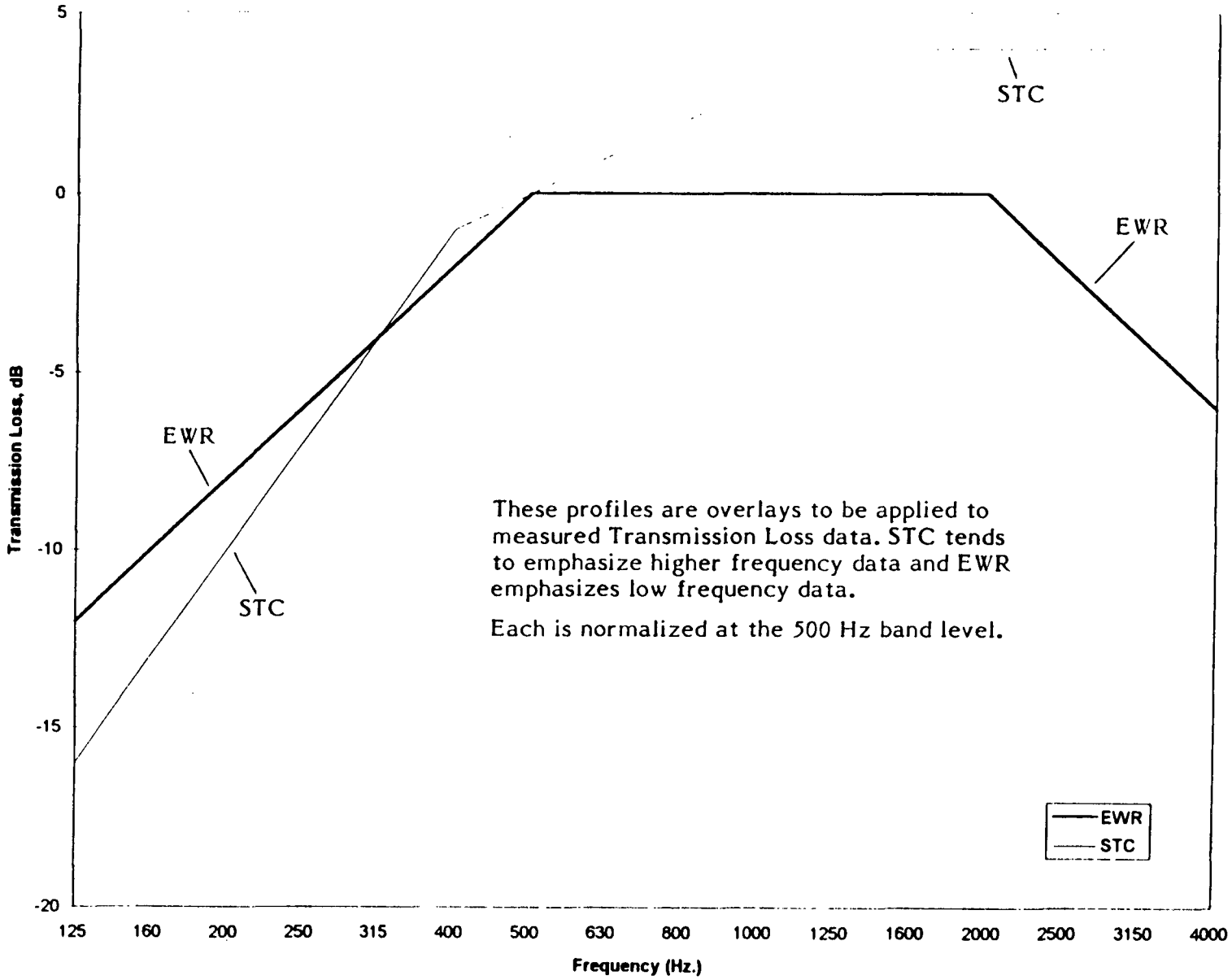


Figure 1. Comparison of EWR and STC Rating Methods.

A new design process comprising new software and field-usable laptop computers was developed in mid-1993, field tested in late 1993 and introduced into the implemented program in 1994. It is based on the practical experience gained in the preceding years and is equivalent to a checklist methodology. The user enters salient information, such as homeowner name, address, location and DNL noise exposure value into an initial menu. Subsequent design decisions will be selected on the basis of that information and pre-existing conditions of each element (doors, windows, walls, etc.). Thus in a DNL 74 dB exposure, a hollow core exterior door would be replaced by a solid core door with an STC (or EWR) rating of greater than 31 dB and an added storm door. Single glazed operable sash windows would be replaced by units having an STC rating of 44 dB, etc.

By means of this checklist procedure, a professional Scope of Work document can be prepared on-site within about 2 hours, using a laptop computer and portable ink-jet printer. It is immediately ready to be reviewed and signed by the homeowner, and suitable (together with pre-prepared product and material specifications) for use as a document for bid and construction as illustrated in Figure 2.

This procedure has been in use since January 1994 and by means of continual comparison has proven to be the technical equivalent to the earlier calculation procedure in that it produces the same design package for most dwellings. Recourse is still made to the acoustical calculations procedure if new or different conditions prevail at a specific dwelling.

A similar design process, using manual checklists for categories of construction in each DNL zone, was developed as a Design Guide for residential sound insulation projects in the vicinity of LAX. That design guide, with some added information, has been republished by the U.S. Navy and the FAA as an advisory document for conducting sound insulation programs.

3.3 Applications and Products

The Sea-Tac program has now been applied to more than 3,300 homes. This is almost half of the initial overall goal of 7,000 homes within the eligible noise contours, and the program is well on-target to meet the commission's mandate. Completion of the program on-time is dependent on the continued availability of AIP grants and Port funding and the voluntary participation of the remaining homeowners within the project boundaries. The AIP grants received to date are listed in Table 2, which also shows the level of completion of the currently active grants. An application for a further $18 million in grant funds has been

SAMPLE
Standard Insulation Package
Scope of Work
Figure 2. Example Scope of Work

INDEX
*Doors
*Windows
*Insulation
*Bathroom/Kitchen Exhaust Ventilation
*Fireplace Modifications
*Ventilation

Scope of Work:

The following Scope of Work shall be referred to attached drawings as supplied with this document and to the Standard Specification and Detail Book dated October 1, 1993.

In all cases, the adjacent surfaces shall be redecorated in a manner and style similar or consistent with the previous finish and trim.

Doors
See Division 8 of the Standard Specification and Detail Book.

*Door 1: Replace existing door with a primary solid core door having and STC rating of at least 31 dB. Add storm door.

*Door 2: Replace existing door with a solid core door having an STC rating of at least 31 dB. New door shall have a factory glazing unit installed to the upper half of the door. Add storm door.

*Door 3: No Changes to door.

Windows
See Division 8 of the Standard Specification and Detail Book.

*Windows 1, 2, 3, 5, 6, 7, 8, 10, and 11
Replace existing window with a Port supplied window assembly having an STC rating of at least 44 dB.

*Windows 4 and 8: No changes to window.

Insulation
See Division 7 of the Standard Specification and Detail Book.

*Attic Insulation
Insulation complying with the material specifications shall be installed in the entire attic area to achieve an equivalent of R-38 insulation standard. Baffle all new and existing attic vents.

Bathroom/Kitchen Exhaust Ventilation
See Division 15 of the Standard Specification and Detail Book.

*Bath
Install exhaust fan and air vent leading to the exterior of the dwelling. Fan shall activate with or without light switch. (owner's decision)

Fireplace Modifications
See Division 10 of the Standard Specification and Detail Book.

Living Room
*The fireplace shall be inspected to determine whether a manually operated damper exists. Disable existing and provide a manually operated damper at the top of the flue suitable for installation in existing construction.

Living Room
*In the vicinity of the fireplace, provide a new Combustion Air Intake.

Ventilation/Air Supply
See Division 15 of the Standard Specification and Detail Book.

*The existing forced air ducted heating system shall be modified to meet the ventilation requirements as specified in the Standard Specification and Detail Book.

***Comments**
Replacement windows are to be manufactured by Alpine (vinyl). Add backdraft damper to kitchen fan if need it.

Table 2

AIP Grant Amounts for Residential Sound Insulation Projects
at Seattle-Tacoma Airport (SEA)

AIP Project	FAA Grant Amount ($K)	Status
3-53-0062-09	1,200	completed
3-53-0062-13	1,100	completed
3-53-0062-17	1,400	completed
3-53-0062-22	3,200	completed
3-53-0062-29	4,300	completed
3-53-0062-31	1,800	completed
3-53-0062-32	10,500	completed
3-53-0062-34	1,500	completed
3-53-0062-36	10,500	90% completed
3-53-0062-38	2,478	90% completed
3-53-0062-40	1,125	75% completed
3-53-0062-42	14,500	50% completed
3-53-0062-**	18,000	applied for

Total number of dwellings completed at August 1995 is 3,238.

submitted to FAA. In mid-1995 there were 1,800 applicants on the waiting list and 800 were in the process of receiving sound insulation. It would therefore seem that the program is widely perceived as desirable.

The actual hardware that is used in the residential sound insulation program comprises mainly a range of products which were developed in the 1960's but have not found a reliable market until the advent of these airport noise programs in the mid-1980's. Many of the original product manufacturers are still in business and others have introduced similar products at lesser cost or with different materials which also meet noise reduction specifications. The same products that were not sufficiently beneficial in the 1960's, because aircraft were excessively noisy, are well suited to the current noise level reduction goals established by the FAA.

As would be expected, the building elements which are usually most significant in controlling exterior-to-interior noise reduction are windows and doors, given that a substantial wall and roof combination exists. If the exterior noise is extremely loud, such as at DNL values of 75 dB and greater, it may become necessary to apply wall and roof modifications other than sound absorptive materials (e.g., thermal insulation) added to attic or wall cavities. This is done by adding a secondary roof or gypsum board to the structure. With additional attention to details such as air vents, mail slots, or other penetrations, and the introduction of a mechanical air ventilation system to reduce the need to open the windows, the sound insulation package is a relatively straightforward retrofit application of construction products.

Two of the more readily apparent differences between the sound insulation package for airport vicinity dwellings and other remedial or remodeling packages are the types of windows and exterior doors. Airport sound insulation products are of much heavier construction to achieve much greater EWR (or STC) ratings than normal products.

Figure 3 shows two configurations of operable sash window construction which have been extensively tested to establish STC (and EWR) acoustical ratings. The "thermal pane" window has dual (insulating) glass in a sealed or unsealed assembly and is typically of 1/2 inch to one inch overall glazing depth, comprising two 1/8 inch glass panes and a 1/4 to 1/2 inch airspace. Tests of readily available examples of this type of product have given STC values from as low as 22 dB up to a better quality product of 29 dB (EWR ratings vary from about

Appendix B

APPENDIX B

DOCUMENTATION ON SCHOOL INSULATION

Port of Seattle

September 14, 1995

Dr. Joseph R. McGeehan
Superintendent Highline Schools
15675 Ambaum Blvd SW
Burien, WA 98166

Dear Dr. McGeehan;

As you know, the Port has tried over the last few years to reach an agreement with the Highline School District on noise mitigation for the schools impacted by aircraft noise. I am asking your help in reopening our discussions about sound insulation for the schools, a topic that seems to have gotten lost in the current debate over airport expansion.

A little history, Sea-Tac Airport's 1985 Part 150 Noise Compatibility Program did not include school insulation. In 1977 there was a $3.6 million legal settlement with the District that included school noise insulation money. In spring of 1992 at a Flight Plan public hearing, former Superintendent Matheson expressed his concerns about the impact of aircraft noise on the learning environment in the Highline schools. As a result of his and others' comments and the passage of Commission Resolution 3125, Andrea Riniker, the Deputy Executive Director of the Port, met with Superintendent Matheson. That meeting resulted in the Port and the District agreeing to develop a long-term plan for addressing noise impacts. In working with the District, the Port took a two-pronged approach: to offer immediate assistance with insulation for Pacific Middle School and Glendale Elementary and to jointly develop with the District a 5-year plan to help us anticipate school and Port work requirements and to settle eligibility and funding issues with the FAA.

As a result of work by both agencies, the District has received two draft agreements from the Port since 1993. One was specific to insulating Pacific and Glendale schools and was very similar to the agreement we have with Highline Community College. Draft amendments were exchanged between the district and Port, with the last set of suggested changes forwarded to the District by the Port in August of 1994. Even though Port staff made efforts to follow up, we have not received a School District response to those revisions. The other draft agreement also was put together with District staff and contained a proposal for

Seattle-Tacoma
International Airport
P.O. Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

how to develop a long-term noise mitigation plan. We did not receive a written response to that plan, either, although we did discuss it with the interim superintendent who preceded you. He told us that the School Board was very unhappy with the draft long-term agreement, but he provided no specifics, and the Port had no opportunity to suggest modifications.

Most recently you and I have had the opportunity to meet and discuss this issue. You informed me of the reluctance of the School Board to agree to working with us on this issue before the PSRC Expert Arbitration Panel had made a ruling. I hope that there may be some change in these feelings. As you may know, the Panel has specifically asked the Port to consider moving ahead with a school insulation and mitigation plan.

We are currently in the midst of a pilot program to insulate public buildings. This program was approved by the FAA in 1994. The pilot project is expected to cost about $3.5 million. It includes two churches, one private school, one convalescent home and one condominium complex. Upon conclusion of the pilot project, we plan to go to the FAA with a request to insulate all similar facilities which meet FAA criteria, over a multi-year plan.

We have also come to an agreement with Highline Community College to insulate all campus buildings, at a cost of approximately $7.5 million. This project has insulated four buildings thus far.

What steps can be taken to get us back on track? Our goal has been, and continues to be, to work out a long-term, district-wide plan on how both agencies can proceed with an insulation plan. We continue our commitment to work with you. Marsha Holbrook will contact your office in a few days to set up a meeting.

Sincerely,

Gina Marie Lindsey

Gina Marie Lindsey, Managing Director
Aviation Division

/b:school.doc

bcc: Dinsmore, Riniker, Strout, Anschuetz, Brougher, Courtney, Feldman, M. Holbrook, Munday, B. Stewart, Summerhays

Port of Seattle

April 28, 1993

RECEIVED
APR 30 1993
NOISE ABATEMENT OFFICE

Ms. Carolyn Read, Puget Sound Planner
Federal Aviation Administration
Seattle Airports District Office
1601 Lind Avenue Southwest
Renton, Washington 98055-4056
SEA-635

Dear Ms. Read:

Re: Grant XX Application (Jobs Bill Grant)

Enclosed is the application and force account that you requested for $5M in jobs bill dollars. As we discussed, the request is to insulate houses (281) and school(s). Documentation from Highline Community College and Highline School District is also enclosed.

The Community College documentation identifies $7.5M that they plan to spend over the next (several) years. It also identifies $4.6M that they could spend this year provided that they receive sufficient funding. My understanding is that some of the projects in the $4.6M package are currently going (or ready to go) out on the streets (in order for them to do the work this summer, they need to start advertising soon). Some additional projects in this package would be advertised as soon as funding is assured. Additional funding would be requested in future regular grants to cover work not included in this jobs bill money.

The School District documentation identifies $900K that they plan to spend in 1994. They might be interested in some dollars to be spent this year in preliminary engineering for that project, with possible construction funding provided in our next regular grant.

Our request is to have $1.5M Granted for "Public School(s) Insulation". We would then work with the Schools and your office to identify the specific work which would be performed this year, the eligibility of the specific items/rooms, the requirement for an Avigation Easement, the funding of the 20% share, etc.

Thank you for your assistance. Let me know if you have any questions.

Sincerely,

Earl Munday
Manager, Noise Remedy

cc: Marsters, Amaechi, Summerhays, Courtney - POS
Jerry Heigh - Highline School District
Laura Saunders - Highline Community College

enclosures

Seattle-Tacoma
International Airport
P.O. Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

0792N/em

PORT OF SEATTLE

MEMORANDUM

DATE: July 16, 1993

TO: Andrea Riniker, Deputy Executive Director

FROM: W. E. Brougher, Acting Managing Director, Aviation Division

SUBJECT: Status Report on Work with the Highline School District and Highline Community College

This memo is to bring you up-to-date on staff work associated with noise mitigation discussions with the Highline School District and Highline Community College. A briefing at our Wednesday morning issues session will also be provided.

BACKGROUND

Gary LeTellier and staff met with Kent Matheson to discuss ways in which the Highline School District and the Port of Seattle can work together. Staff from each agency was subsequently directed to jointly develop a scope for a study that would help the Port and District address aircraft noise problems. The District assigned Dr. Nancy Angelo who heads their Training and Research Department and the Port assigned Diane Summerhays.

STATUS

Direction for working with the school district came from the meeting with Gary and the school superintendent and from the Resolution 3125 directive to include schools in the insulation program. The goal for this effort is to develop a realistic, "do-able" joint proposal or plan that outlines the best options for addressing aircraft noise within the school district. Staff from both agencies have been proceeding with the idea that the draft proposal or plan can then be considered by both agencies as the basis for an interlocal agreement that will define how we work together on mitigation of noise impacts and compatibility planning, including the location of existing and future schools. Most recently, due to opportunities discussed below, we are recommending the interlocal agreement come prior to the completion of a draft plan.

A major criteria for any draft plan is that options be eligible for FAA funding or PFC funding. The FAA will in all likelihood call into question the eligibility of funding schools in very high noise areas with no plans to examine relocation. While a draft plan should contain specific mitigation options, it is also important that it include studies or additional information or guidelines that can be used in future planning, siting and building of school facilities. It should also help in serving as a model for future cooperative ventures between the Port and District.

SHORT TERM ASSISTANCE TO SCHOOLS

Based on directives from Resolution 3125, the Noise Remedy staff has been seeking opportunities that exist for immediate assistance to the Highline School District and Highline Community College. These opportunities will likely arise prior to completion of the draft plan mentioned above. While some large dollar amounts are being discussed in relation to the two agencies' facilities plans, the first step is to determine what is eligible and to then determine how much funding is appropriate, available and could be requested in a grant application. No actions will be recommended that in anyway jeopardize the plan to insulate single family homes at the accelerated rate.

Highline Community College

Highiine Community College remodeling plans indicate a capital budget of $30 million through 2000, with approximately $7 Million for acoustical treatments, some of which may not be eligible for federal funding. The college is proceeding with some of the work this year; they have indicated that the timing on the work will be affected by availability of funds from the State and the Port. After discussions with the FAA, we will have a better idea of what is eligible and how much would be appropriate and possible to include in a grant request.

Highline School District

In the Highline School District remodeling plans, which require $300 million, the district has specified a need in excess of $50 million for acoustical treatment. This amount was discussed in meetings between the Port and district. While they have a very detailed estimate and schedule for all remodeling/reconstruction, the district must first pass a bond.

Highline School District at this time has funding available only for remodeling Pacific Middle School, including $900,000 for acoustical treatment (out of a total of $3,600,000). This work is planned for the the 1994 construction season and is the focus of the discussions on immediate funding assistance to the school district. As with Highline Community College, discussions with the FAA will clarify a number of issues and a determination can be made about an appropriate grant request.

We see this immediate work as a "sign of good faith" that will help us in future negotiations over compatibility planning with the Highline School District, in particular. However, we do not intend to assist in funding further work for the Highline School District until there is an interlocal agreement and a study. If the district proposes any other work, we will brief you.

NEXT STEPS

We will proceed as noted above to: (1) Work with the school district, Highline Community College and FAA to define mitigation that is eligible for federal funding and, if possible, include funding for some items in a grant request; (2) Work to develop an interlocal agreement formalizing a cooperative relationship on noise mitigation with the schools; (3) Proceed with working on a school district/Port plan; (4) Brief you in an upcoming Wednesday Executive issues session.

cc: Dinsmore, Blood, Strout, Stewart, J. Johnson, Yamanaka, Anschuetz, Munday, Summerhays

1234X

Port of Seattle

September 10, 1993

Ms. Carolyn Read, Puget Sound Planner
Federal Aviation Administration
Seattle Airports District Office
1601 Lind Avenue Southwest
Renton, Washington 98055-4056
SEA-635

Dear Ms. Read:

Re: Eligibility of Insulation Treatments for Schools

This is to request FAA identification of items eligible for Federal Funding in proposed insulation remodel plans of Highline Community College and Pacific Middle School. The actual funding proposed to be used at this time is PFC, however Federal eligibility is a criteria to using those funds.

Enclosed are budgets and plans for those projects along with the bidding and award criteria used to hire the designers. A summary sheet of types of eligibility questions is also enclosed. Construction on both of these projects is expected to be done (begun in the case of the College) during the summer of 1994. Final design, bidding, and award will have to be done in late 1993 and early 1994 in order to meet that construction schedule. The final design, bid packages, and awards will vary depending on the eligibility (and ultimate commitment of funding by the Port). Therefore, it is critical that we get a reply as soon as possible.

You have indicated a response availability with a month turnaround (at least on some items). If you will be unable to meet that time frame, please let me know.

We are working with the school district to develop a long term interlocal agreement. We will also decide the issue of whether or not an Avigation Easement is required/desired. If you have any questions, please contact me at 431-5915.

Sincerely,

Earl Munday
Manager, Noise Remedy

cc: Peter Babington - Highline Community College
Jerry Heigh - Highline School District
Jerry Osborn - Meng Associates
Summerhays, Garson, Amaechi - Port of Seattle

Enclosures (list next page)

0051N/em

Seattle-Tacoma International Airport
PO Box 68727
Seattle WA 98168 U S A
TELEX 703433
FAX (206) 431-5912

Enclosures List for Read Letter 9/10/93

1. Two page document titled "School Eligibility Questions".

2. Letter to Earl Munday from Gary Frentress dated 8/27/83 about Highline School District s reasoning for replacing rather than remodeling schools - "Noise Mediation - Pacific Middle School".

3. Letter to Earl Munday from Dr. Nancy Angelo (undated) about Highline School District's reasoning for being unable to relocate schools outside the 65 DNL contour.

4. Report "Pacific Middle School East Wing Remodel" dated 8/25/93 indicating budget costs and plans.

5. Report "Highline Community College Noise Abatement" dated 8/23/93 indicating detailed budget costs and plans.

6. Letter to Earl Munday from Jerry Osborn dated 8/24/93 about acoustical study contract for Highline Community College.

7. Letter (and associated documents) to Earl Munday from Gary Fentress dated 8/23/93 about Architectural Design selection for Pacific Middle School.

8. Meng report of qualifications dated 4/26/93.

9. Various letters between Meng & Highline Community College dated 5/93-8/93 regarding Meng being selected as consultant for the College.

10. "Consultant selection Panelist Information Package Project No. 93-194" related to selection of consultant for Highline Community College.

11. Draft report "Comparison of Aircraft Noise ... Loma Portal Elementary School dated 7/93 about the results of the FAA funded insulation of a school in San Diego.

12. Draft Report "Sound Insulation of Loma Portal Elementary School - Final Report" dated 4/93 about the FAA funded sound insulation of the school in San Diego.

SCHOOL ELIGIBILITY QUESTIONS

A. What types of rooms/buildings are eligible
   1. Classrooms
   2. Labs (science, print shop, art, performing arts)
   3. Library
   4. Lecture hall
   5. Teacher's Offices
   6. Student Center
   7. Administrative offices
   8. Childcare facilities
   9. Pavilion (multipurpose room)
   10. Other (gyms, restrooms, cafeterias, carpentry labs, auto repair labs, etc.)

B. What types of treatments are eligible
   1. Reduce noise through the shell
      a. Replacement or storm windows/glazing
      b. Replacement doors
      c. Additional walls/mass added to walls/walls reconstructed
      d. Additional ceilings/mass added to ceilings/ceilings reconstructed
      e. Additional roofs/mass added to roofs/roofs reconstructed

   2. Reduce noise reverberation within the room
      a. Carpeting
      b. Window coverings
      c. Acoustical ceiling tile
      d. Upholstered furnishings

   3. Ventilation
      a. Ductwork (new and/or modified)
      b. Fans
      c. Air Conditioning
      d. Electrical service
      e. Attic insulation
      f. Ventilating air outlets

   4. Miscellaneous
      a. Asbestos removal required to provide eligible treatments
      b. Building code requirements related to eligible treatments
      c. Building code requirements unrelated to eligible treatments, but required due to eligible treatment project size.

C. Eligibility of planning/design
   1. Architectural design of eligible treatments
   2. Acoustical testing
   3. Administrative costs (by schools) related to project

D. Retroactivity eligibility - what costs already expended are eligible
   1. Design of eligible treatments
   2. Acoustical testing
   3. Administrative costs related to eligible treatments
   4. Construction of eligible treatments

E. Remodel vs reconstruct eligibility (eligible treatments)
1. Replacement of temporary (un-insulatable) rooms with permanent rooms
2. Reconstruct buildings where it is more economical than remodel (see enclosure from Highline School District)

F. Design Criteria (these are the criteria used for FAA funded insulation for schools in the California area)
1. Qualify based on 65 DNL (current FAA accepted contour - ~~1991~~)
2. Design to interior noise level of 45 Leq based on worst "normal" hours of class (i.e. south flow for schools south of airport, 8:00-9:00 A.M., average mix of aircraft).

G. Miscellaneous Eligibility
1. Location of school a factor (assuming that interior criteria can be achieved and that ultimate (year 2000) contour is less than /5) (see enclosure from Highline School District)

U.S. Department
of Transportation
Federal Aviation Administration

Seattle Airports District Office
1601 Lind Avenue S.W.
Renton, WA 98055-4056

December 16, 1993

Mr. Earl Munday
Manager, Noise Remedy
Port of Seattle - Maywood Office
1410 South 200th Street
Seattle, Washington 98148

Dear Mr. Munday:

Seattle-Tacoma International Airport, Seattle, Washington
Noise Remedy Program - Eligibility of Insulation Treatments for Schools

This is in response to your request of September 10, 1993, concerning eligibility of insulation for schools.

1. Item A: What types of rooms/buildings are eligible?

Classrooms; teachers offices; labs (which require a quiet atmosphere for educational purposes), such as science and art; libraries; and lecture halls used for classes are considered eligible. Child care facilities; multipurpose rooms; gyms; rest rooms; cafeterias; locker rooms; pavillions; plant operations; and labs (which do not require a quiet atmosphere for educational purposes such as auto repair, carpentry, shop etc.) are not considered eligible.

2. Item B: What types of treatments are eligible?

a. Noise through the shell: Noise reduction can usually be achieved with some combination of window and door replacement, ceiling insulation, caulking, weather stripping, and central air ventilation systems. The design goal for schools is to achieve a minimum interior noise level based on the time-average A-weighted (normal school hours e.g. 8:00 am - 3:00 pm) sound level of 45 dB and reduce the existing noise by at least 5 dB. A design analysis is required to establish the design goal, establish the existing benefits (in reducing noise) from the structure and indicate the *added treatment* needed to meet the goal. If the design analysis requires treatment beyond those mentioned above, such as additional wall or roof mass, an analysis is required and will be reviewed by Federal Aviation Administration (FAA) Headquarters. If the Port of Seattle (POS) would like further consideration of *added treatments*, provide an analysis as described above and we will forward it to Headquarters for approval. Interior wall treatments are not eligible. We are returning your enclosures 4 and 5 so that the above can be incorporated prior to further consideration.

b. Reverberation: Costs for reducing reverberation are not eligible.

c. Ventilation: The design goal is to provide adequate air exchange in order to achieve volume changes of two air changes per hour. The design analysis should address the basis for the construction proposed. The ductwork, fans, air outlets, and electrical service required to achieve the ventilation goal are eligible. The Federal participation toward the air conditioning is limited to the cost of a positive ventilation system. The owner must be informed of the maintenance costs. Attic insulation is not eligible unless it is required to achieve the design goal stated in paragraph 2a item B.

d. Miscellaneous: Asbestos removal is not eligible. Repairs needed to meet building codes are not eligible; however, building code requirements related to authorized treatments can be eligible. Building code requirements unrelated to authorized treatments are not eligible.

3. Item C: Eligibility of Planning and Design: Architectural design of authorized treatments is eligible. If acoustical testing is required to ensure the design goals are achieved, it is eligible; however, the FAA and POS will need to agree on a plan specifying the extent of acoustical testing. Administrative costs are eligible if reasonable and necessary to implement an insulation program. Administrative costs must be approved in a force account plan, prior to expending costs, in order to be eligible.

4. Item D: Retroactivity: Passenger Facility Charge (PFC) funds can be used retroactively if the construction Notice to Proceed date was on or after November 5, 1990. If this is the case the use of PFC funds for project formulation and construction costs of authorized treatments are eligible.

5. Item E: Remodel vs. Reconstruct: The intent of Federal Aviation Regulation (FAR) Part 150 is to identify noise impacted areas and to help remedy and reduce the noise impacts on the community. This is done by land use planning, instituting building codes, insulating structures that were built before the maps were published, and relocating structures (e.g. mobile home parks) that cannot become compatible in a cost effective manner. The program is not designed to participate in new construction within the impacted areas. Participation in new school construction (in a new location) is not eligible; however, noise insulation (no change in location) of an existing school would be considered eligible. Federal participation would be limited to the lesser cost of 1) insulating the old structure compared to, 2) the incremental cost of insulating the new rehabilitated structure. Only the costs for noise insulation (e.g. replacing windows) are considered eligible. Not the cost of updating the structures.

6. Item F: Design criteria: The POS noise program boundaries are based on the year 2000 maps. If the POS would like to declare a different map for eligibility of schools and hospitals, then that map would need to apply to all schools and hospitals in your program. The POS should also be consistent in applying the eligibility criteria. For example, if the POS chooses a 1991 map and a school is currently in the 75 DNL, then that school is considered non-compatible and should be moved. On the other hand, the school within the 65 DNL could be insulated. We would encourage that the most impacted structures be treated first.

7. Item G: **Miscellaneous Eligibility:**

Location of schools: Same comment as above. Because the program boundaries are currently based on the year 2000 maps, we would refer to those contours to determine eligibility. If the school would be outside the 75 DNL contour by the year 2000, and can meet the interior noise reduction requirements today (e.g. 45 db minimum interior noise and 5 db reduction), the school would be eligible for treatment.

Pacific Middle School East Wing Remodel:

- Only the costs for noise insulation are considered eligible. Not the costs of updating the structures.
- Temporary moving of occupants is not eligible.

Highline Community College:

- Only the costs for noise insulation are considered eligible. Not the costs of updating the structures.
- In regards to the Meng acoustical study; we do not endorse design goals based on audits done with the windows open.
- Since this consultant contract would be funded with PFC money, the FAA need not approve the consultant selection process, fees etc. We would recommend that the POS ensure the costs are reasonable and the process meets state and local requirements. We are returning your enclosures 6 through 10.

The above are general eligibility comments and we will need to review a more specific proposed noise mitigation program for the schools before the program is initiated. We encourage the Port and schools to develop a plan before we proceed with funding.

We hope this adequately addresses the issues concerning eligibility of insulation treatments for schools. If you have any questions regarding the above, please contact Carolyn Read at 227-2661.

Sincerely,

J. Wade Bryant
Manager, Seattle Airports
District Office

HIGHLINE PUBLIC SCHOOLS

FACILITIES AND MAINTENANCE DEPARTMENT
18010 8th Avenue South Telephone: (206) 433-2501
Seattle, Washington 98148 FAX NO: (206) 433-2147

2

August 27, 1993

Earl Munday
Port of Seattle
P.O. Box 68727
Seattle, WA. 98168

RE: Noise Mediation - Pacific Middle School

Dear Earl,

I would like to outline the District's reasoning for replacing rather than remodeling schools. I would first point out that not all schools will be replaced. Our secondary schools typically will be remodeled.

Due to the age of many of our schools, the mechanical and electrical systems are severely worn, outdated, and under capacity. Replacing the utilities by itself will trigger the requirement to meet present building codes (ie. fire, handicap, health, environmental, hazardous materials, energy). To meet the code and noise mitigation requirements inevitably requires the replacement of walls, windows, doors, and roofing. This leaves very little of the original structure but many of its limitations.

Briefly, the limitations of a remodeled building and the effect of these limitations include:

1. A greater surface area which increases heating and sound attenuation costs.
2. A bigger footprint which leaves less area for playground and increased parking requirements.
3. More entrances and blind spots which are a security problem.
4. Higher change order costs due to hidden conditions.
5. Higher maintenance costs due to longer piping and wiring runs.
6. Higher life cycle costs due to the reused materials.
7. Scheduling problems between construction activities and student activities.
8. Building inefficiencies because the building "pieces" don't fit the existing structure neatly.

Additionally, the state guide lines for architectural fees are 50 percent higher for remodelling than for replacing an equal area. This recognizes the fact that major remodels are simply more difficult projects.

I am enclosing a spreadsheet comparing costs for all the schools we are currently planning to replace. The remodeled costs are based on extensive studies of each school by design and engineering teams and the replacement costs are based on our experience with the recent replacement of Seahurst Elementary and our knowledge of square footage costs for this type of work.

The Facilities staff is convinced that replacing the listed schools is more cost effective than trying to remodel them.

Please inform us of any additional information or clarifications you may need regarding this issue.

Sincerely,

Gary Frentress
Construction Scheduler

GF:mh
encl.

cc: Jerry C. Heigh

Replacement vs Modernization Costs

Cost Adjustments to Meet 600 Student Capacity

School	*S&S Cost	Exist Sq Ft	Mod Sq Ft	Ttl SF Req'd	Add'l SF Req'd	Add'l SF Costs	Code Costs	Project Cost
Bow Lake	4,831,229	33,682	42,897	63,000	20,103	2,713,905	900,500	8,445,634
Cedarhurst	7,295,199	39,856	54,306	63,000	8,694	1,173,690	900,500	9,369,389
Gregory Hgts	6,310,328	47,608	53,208	63,000	9,792	1,321,920	900,500	8,532,748
Hazel Valley	6,481,850	45,469	56,119	63,000	6,881	928,935	900,500	8,311,285
Madrona	7,857,078	34,139	52,689	63,000	10,311	1,391,985	900,500	10,149,563
McMicken	9,152,900	37,027	51,807	63,000	11,193	1,511,055	900,500	11,564,455
Mt View	6,627,868	44,418	55,718	63,000	7,282	983,070	900,500	8,511,438
North Hill	6,123,932	38,502	49,181	63,000	13,819	1,865,565	900,500	8,889,997
Riverton Hgts	5,162,867	42,007	52,357	63,000	10,643	1,436,805	900,500	7,500,172
Seahurst	9,544,934	53,278	59,978	63,000	0	0	900,500	10,445,434
Shorewood	5,033,926	41,635	48,935	63,000	14,065	1,898,775	900,500	7,833,201
White Center	3,871,163	32,245	40,745	63,000	22,255	3,004,425	900,500	7,776,088
							Total	107,329,404
							Avg	8,944,117

* See Column Notes For Explanations.

Typical Project Costs & Savings in Current Dollars(a)

Construction Type	1990 Dollars	1993 Dollars	Avg Savings	Total(b) Savings
Remodelling	8,944,117	10,871,630	N/A	N/A
Replacement	7,800,000	9,480,949	1,390,681	16,688,176

(a) Inflation is Estimated at an Annual Rate of 5%.
(b) Total Savings is Based on the 12 Schools Listed

COLUMN NOTES:

1. The Study & Survey was Completed in July 1990.
2. The Existing Area was Calculated for the Study and Survey.
3. The Modernized Area Includes Additions Shown in the Study and Survey.
4. The Total Area Required for 600 Students is Based on the District Standard of 60,000 SF with a Building Inefficiency of 5%.(ie 60,000*1.05)
5. The Difference Between the Area Required for 600 Students and the Area Accounted for in the Study & Survey is the Additional Building Area Required.
6. The Cost of the Additional Area is Multiplied by $100/SF Construction Cost with 35% Added for Soft Costs.(ie Sales Tax, Design, Testing ...)
7. Code Update Costs are Based on Regulation Changes Subsequent to the Study & Survey Which are Included in the Replacement Costs.

Add'l Requirements Since 1990 Study	Add'l Costs	Revised/New Regulations
Parking/Drainage	243,000	King Co/Local Zoning
Streets & Sidewalks	270,000	King Co/Local Zoning/GMA
Computer Network	202,500	District Standard
Handicap Access	135,000	Federal ADA Requirements
Permit Costs	50,000	King Co/Local Zoning
	900,500	

8. The Project Cost is the Total Adjusted Cost in 1990 Dollars

PORT 0003397

27-Aug-93

HIGHLINE PUBLIC SCHOOLS

EDUCATIONAL RESOURCES and ADMINISTRATIVE CENTER
• 5675 Ambaum Boulevard SW • Telephone 206-433-0111
Burien, Washington 98166

The mission of the Highline School District is to enable all students to acquire the knowledge, skill, values and attitudes to live productively and responsibly in a diverse and ever-changing world.

Research and Evaluation

3

Mr. Earl Munday
Port of Seattle
P. O. Box 68727
Seattle, WA 98168

Dear Mr. Munday:

Recently the Port of Seattle and the Highline School District have been discussing the need for the school district to construct schools inside the 65 LDN zone. It is unfortunate but necessary that schools be built within the 65 LDN zones. The Highline School District exits in a urban/suburban setting that is highly settled. The property available within the district consists of strips of land surrounding the airport and bounded either by water or other districts. The District is bounded on the west by Puget Sound, on the north by the Seattle School District, on the east by the South Central and the Kent school districts and on the south by the Federal Way school district. The central core corridor of acreage within the district is occupied by the Seattle Tacoma International Airport. There is just not that much land available when airport acreage is subtracted. The few tracts that remain, as can be seen by reviewing the attachment, are not suitable for school construction. The attachment identifies the tracts large enough to meet the acreage required for school buildings in Washington state. The few tracts large enough are for some reason not acceptable, or are not located near the students that need to be housed.

There is another way to secure land to build upon in order to site schools outside the 65 LDN, namely of property condemnation. Input received from the numerous community meetings during the last series of school closures, as well as from the community more recently, has indicated to the School Board that condemnation is not a viable option for the District. In the 1970's the Port of Seattle did condemn hundreds of residential dwellings within district boundaries that lay to the north and south of Sea Tac airport runways. This included and caused the closing of several schools. The public was loud in its opposition to this action. Currently the relationship between the citizens and the Port of Seattle is strained over the issue of an additional runway. It would be very ill advised for the Port or the School District to condemn residences for schools. The hostility would most certainly manifest itself in citizen ill will towards the Port and School District and lack of citizen support for operations and maintenance school levies, on which the school district depends.

Sincerely,

Nancy Angello

Dr. Nancy Angello
Director, Research and Evaluation

Attachments

PORT 0003398

VACANT PROPERTIES
WITHIN THE HIGHLINE SCHOOL DISTRICT

	LEGAL	SITE OWNER	ACREAGE	USE/CONDITION
1.	4-12-23-03	KING COUNTY	29.42	SEOLA PARK
2.	4-12-23-03	KING COUNTY	31.63	SEOLA PARK
3.	4-13-23-03	KING COUNTY	75.82	SEAHURST PARK
4.	1-13-23-03	LANE HILLS INC	12.16	STEEP HILLSIDE
5.	1-13-23-03	KING COUNTY	48.74	STEEP HILLSIDE
6.	3-18-23-04	KING COUNTY	14.28	SEAHURST PARK
7.	2-18-23-04	KING COUNTY	13.11	SEAHURST PARK
8.	3-18-23-04	SEAHURST MANOR APTS.	24.55	STEEP SLOPE
9.	3-20-23-04	KING COUNTY	13.96	MOSHIER FIELD
10.	3-29-23-04	HOFFMAN IRMA S	24.96	SWAMP (WETLAND)
11.	1-30-23-04	HIGHLINE YOUTH FOUNDATION	10.09	KIWANIS PARK
12.	2-09-22-04	KING COUNTY	17.09	PARK
13.	3-16-22-04	STATE OF WASHINGTON	38.01	HIGHLINE COL.
14.	4-17-22-04	HIGHLINE SCHOOL DISTRICT	11.57	ZENITH PARK
15.	3-06-22-04	CORLISS MICHAEL J. & TAMRA A.	11.51	STEEP HILLSIDE
16.	1-07-22-04	CITY OF NORMANDY PARK	25.88	PARK
17.	4-30-23-04	CITY OF NORMANDY PARK	15.58	PARK
18.	3-03-22-04	ARMONDO SCOCCOLO	18.90	STEEP HILLSIDE
19.	3-04-22-04	KING COUNTY	42.24	ANGLE LAKE PARK
20.	1-04-22-04	PORT OF SEATTLE	16.45	AIRPORT
21.	1-05-22-04	MEAN HERB T	13.29	DEVELOPMENT INSIDE 65 LDN
22.	2-10-22-04	SCALZO VICTOR J	10.04	HILLSIDE
23.	2-10-22-04	DONOFRIO KATHERINE I	11.40	HILLSIDE
24.	2-25-22-04	KING COUNTY	37.70	GRANDVIEW PARK

25.	3-16-23-04	PORT OF SEATTLE	13.43	POS ACQUISITION
26.	2-16-23-04	PORT OF SEATTLE	15.28	POS ACQUISITION
27.	3-16-23-04	PORT OF SEATTLE	11.00	POS ACQUISTION
28.	3-16-23-04	PORT OF SEATTLE	11.04	POS ACQUISTION
29.	3-16-23-04	PORT OF SEATTLE	11.18	POS ACQUISTION
30.	4-17-23-04	PORT OF SEATTLE	17.21	POS ACQUISTION
31.	4-20-23-04	PORT OF SEATTLE	27.17	AIRPORT
32.	2-21-23-04	PORT OF SEATTLE	17.02	AIRPORT
33.	3-26-23-04	CASTELLO LAND CO INC	13.95	STEEP SLOPE
34.	1-28-23-04	PORT OF SEATTLE	12.35	AIRPORT
35.	3-34-23-04	COLACURCIO BILL JR	17.02	INSIDE 65 LDN
36.	4-34-23-04	KING COUNTY	27.74	VALLEY RIDGE PARK
37.	3-03-22-04	UNION PAC. LAND RESOURCES	14.79	STEEP HILLSIDE
38.	9-04-23-04	SEATTLE CITY LIGHT	17.60	TRANSMISSION LINES

Port of Seattle

September 17, 1993

PL 1.3.3

Dr. Nancy Angelo
Highline School District
15675 Ambaum Blvd. SW
Seattle, WA 98166

Dear Nancy:

I was hoping to be able to transmit a draft copy of an interlocal agreement for your review and comment before I left on vacation. My workload and the fact that we have a new Managing Director who needs to be fully briefed on this subject before we proceed keeps me from meeting this schedule. However, it may help us take advantage of the time I will be gone if I provide you with an outline of the agreement elements as they now stand so that you can consider issues before getting the actual draft document.

Outline

1. To include history, background, etc, there is a section of "WHEREASs".

2. Purpose and commitment. Statements about proceeding in cooperative manner to address effects of aircraft noise. The agreement purpose is to provide goals and a framework for developing a Noise Mitigation Plan, which will then be presented to both governing bodies.

3. Development of Noise Mitigation Plan. I am assuming that we will want to acquire professional services. The cost is a rough estimate, but I think it will run about $50,000.

4. Project management duties and funding of the plan. We need to show that both agencies are sharing the costs. We will likely be proposing an arrangement of some sort. You might want to consider how the District can contribute, i.e. force account, cash, or combination. We anticipate looking for the majority of funding from FAA or PFCs (Port funds).

5. Noise metrics and actions sought. We have already discussed the importance of giving priority to those mitigation elements that are eligible for FAA or PFC funding and this should be in the agreement. Eligibility is also dependent somewhat on how impact is analyzed. To maintain eligibility for federal funding and PFCs, noise analysis should be based on DNL and the most recent FAA accepted noise contours. The Port will be willing to consider using other metrics as well if appropriate.

Seattle-Tacoma
International Airport
P.O. Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

Port of Seattle

October 18, 1993

Dr. Nancy Angelo
Highline School District
15675 Ambaum Blvd. SW
Seattle, WA 98166

Dear Dr. Angelo:

Enclosed is a preliminary draft of an interlocal agreement. (Our Legal Department has some question about whether it should be a memorandum of agreement instead. We can figure that out later.) I am looking forward to discussing it with you on Wednesday, Oct. 27 at my office at 2 pm. Please call if you have any issues you would like to discuss prior to our meeting.

Sincerely,

Diane

Diane Summerhays
Planning Program Manager

cc: Stewart ✓

1342X

Seattle-Tacoma
International Airport
PO Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

DRAFT

DRAFT INTERLOCAL AGREEMENT

INTERLOCAL AGREEMENT

This interlocal agreement is entered into on_____, 1993, between the Port of Seattle (Port) and the Highline School District (District).

WHEREAS, Seattle-Tacoma International Airport (Airport) and the Highline School District are adjacent to each other and have grown and changed in response to the needs of the public they each serve; and

WHEREAS, the Highline School District borders the Airport on all sides with approximately thirty-five percent of the students of the District currently attending sixteen schools located within the 65 DNL noise contour; and

WHEREAS, the effects of aircraft noise on the children attending the Highline schools is a serious concern to both the School District and the Port of Seattle; and

WHEREAS, the Port and the District recognize that planning for compatibility between the Highline schools and the Airport, including the mitigation of aircraft noise, is a joint goal and responsibility of both parties; and

WHEREAS, in 1977, a legal settlement concerning the effects of aircraft noise on the schools within the District resulted in the Port providing three million seven hundred thousand dollars ($3.7 million) to the District for sound insulation purposes. In consideration, the Port received avigation easements on thirteen school properties and fee simple title to one school property of the Districts. The School District subsequently used the funds on insulation work for some schools; and

WHEREAS, subsequent to the 1978 settlement, aircraft operations have increased and the Port has adopted noise abatement programs to mitigate and control the effects of increased operations on the surrounding communities; and

DRAFT

DRAFT

WHEREAS, in 1984/85, the Port developed the current Noise Remedy Program for single family residences through an extensive community District/Port process, but the Noise Remedy Program did not include a school insulation component; and

WHEREAS, the District's current facilities plan indicates a need for noise insulation work occurring over the next seven years; and

WHEREAS, in November 1992, the Port of Seattle Commission instructed staff through Port of Seattle Commission Resolution No. 3125 to develop and implement amendments to the Port's acoustical insulation program to include schools; and

WHEREAS, in July 1993, Port and District staff began discussions with the FAA on funding options for sound insulation work associated with Pacific Middle School and work is progressing on this project;

The parties agree as follows:

I. *PURPOSE AND COMMITMENT*

1. The Port and the District agree to proceed in a cooperative manner to address the effects of aircraft noise on the District schools through the development of a 5-year Noise Mitigation Plan (Plan). This Agreement provides goals and a framework for the Plan and sets forth responsibilities for both its funding and preparation.

2. The District and Port intend to use the Plan as the foundation for the course of action to be taken by the District and Port in studying, evaluating and accomplishing specific noise mitigation measures.

3. District and Port staff will develop a draft Plan to present to their respective governing bodies. Each governing body shall comment on the draft Plan and may recommend changes or additions. No actions will be taken to implement the Plan until official approval and concurrence is provided by both governing bodies, and funding sources are identified and agreed upon. Once approved, the Plan will become final and shall be incorporated into this Agreement by written amendment thereto. The Plan shall represent the commitment of the Port and the District to address the impacts of noise mitigation within the District.

DRAFT

II. *DEVELOPMENT OF PLAN*

DRAFT

1. Consultant Costs and Schedule

   a. The District and Port have determined that professional consulting services are needed to assist in developing a draft Plan. Professional services are expected to be approximately $50,000.

   b. The Port and the District will cooperate with the Consultant and each other in providing all necessary and pertinent data, reports, forecasts, inventories and other documents in such a manner as to be consistent with previous planning activities undertaken by both entities, and in an effort to reduce time and expenses in developing the Plan.

2. Project Management Duties

   a. The Port and the District will each assign a project manager (PM) to the Noise Mitigation Plan Project. Through a process agreed to by the Port and District PMs, the Port will engage and retain an independent contractor (Consultant) selected jointly by the District and Port. The scope or work will be developed jointly by the Port, District and consultant.

   b. After the Consultant has been retained, the primary project management role will be assumed by the District's PM, who will also take the lead in directing the Consultant in accordance with the finalized scope of work. Regular coordination and briefing meetings will be held between the Port and District to ensure open communications and concurrence on significant decisions and resolutions to problems.

   c. Any changes to the Consultant's scope of work or to the amount of the Consultant's contract must be approved by both the Port and District.

   d. All decisions relating to drafts of any section of the Plan must be approved by both the District and Port prior to inclusion in the draft Plan or prior to circulation of it to persons outside the project team or management of the Port and District.

DRAFT

DRAFT

3. Funding to Develop the Plan

a. To provide access to major funding sources, the Plan will give priority to goals and noise mitigation measures that are consistent with FAA policies and that are eligible to use monies from the FAA and from Airport funds received through collection of Passenger Facility Charges (PFC). In addition, the Plan will explore, identify and evaluate other funding sources.

b. The Port will seek funding through an FAA grant application or through a request to the FAA for approval to use PFC funding to develop the Plan. The Port will also consult with the FAA in determining processes and procedures for conformity to federal regulations and guidelines in obtaining consulting services using federal funds.

c. The Port and District will share the cost of the project with the Port supplying 90% of the cost through FAA or PFC sources. The District will provide 10% of the cost in either direct funds or by force account.

4. Noise Metric for Analysis

Noise analysis for the Plan will be based on the use of the Day/Night Noise Level (DNL) noise metric as generated by the most recent version of the FAA's Integrated Noise Model (INM). In addition, noise impact and funding eligibility will be based on the most recent FAA-accepted Sea-Tac Noise Exposure Map for existing conditions. This shall not preclude the use of other supplemental metrics in development of the Plan as long as FAA funding eligibility is maintained and the Port and District agree to their use.

DRAFT

III. GENERAL COMPONENTS OF THE PLAN

Planning Process

The Plan will include, at a minimum, the following elements:

1. Project Definition. This will include roles and responsibilities of Port, District and Consultant.

2. Definition of Goals. Definition of goals will be as specific as possible about what the Plan is to achieve, the specific products of the Plan and the time frame for completion.

3. Inventory and existing conditions. Information gathered will include an inventory of all schools within the 65 DNL, a description of all existing District plans concerning new or remodeled schools, and an explanation of aircraft operations and noise exposure.

4. Forecasts. Forecasts will relate to both aircraft operations and population forecasts relevant to school facilities. The Plan will utilize existing Port of Seattle aircraft operations forecasts compatible with recent Port/PSRC Flight Plan Project forecasts. The Plan will also utilize forecasts of population and student growth consistent with the District's most recent facilities planning studies.

5. Alternatives Evaluation and Criteria. A list of available noise abatement and mitigation options will be assembled and evaluated, i.e. school relocation, berms or barriers, etc. Criteria for selecting a recommended plan will be defined and explained.

6. Public input. The Plan will define the public review process of the proposed actions.

7. Funding. Funding sources will be identified, including conditions necessary to access sources. A funding policy will be recommended.

8. Recommended Plan. Based on the criteria, alternatives evaluation and funding sources, a recommended plan will be presented.

9. Implementation Procedures and Timeline. Roles and responsibilities of each party will be defined and a timeline developed.

DRAFT

DRAFT

10. Monitoring of Results. A mechanism will be recommended for tracking results.

IV. GOOD FAITH EFFORTS

The Port and District agree that as long as both parties are, in good faith, adhering to the intent of this agreement and moving forward with development of the Plan, both parties will continue to cooperate with each other and neither party will file litigation against and/or seek damages from the other, or engage in activities which could be construed as adversarial to the other on issues related to aircraft noise.

We, the undersigned, representatives of the Highline School District Board and the Port of Seattle Commission do hereby signify our support for the preparation of a Noise Mitigation Plan as described in this document, and pledge the support of our staffs in the implementation of the program proposed herein.

Signed this_____day of_____, 1993.

_____
Chairman,
Highline School Board

_____
President,
Port of Seattle Commission

c:word\noise\part150\amndmnts\intrlcl.doc\tt

DRAFT

HIGHLINE PUBLIC SCHOOLS
FACILITIES, MAINTENANCE AND OPERATIONS DEPARTMENT
18367 8th Avenue South
Seattle, Washington 98148
Telephone: (206) 433-2501
FAX No.: (206) 433-2147

July 15, 1994

Mr. Earl Munday, Director
Port of Seattle Noise Remedy Program
P.O. Box 68727
Seattle, Washington 98168

Attached is the District's attempt to draft an agreement between the Port of Seattle and the Highline School District to enable dissemination of sound attenuation dollars for projects the District has done, is doing, or will be doing for which the District has funding. As you know, the District has several additional projects planned, but until funding is achieved the projects will not begin.

Please note this agreement is only for the New Beverly Park at Glendale Elementary School which has been completed (sound attenuation costs approximately $956,000), and Pacific Middle School (sound attenuation costs approximately $744,000). The agreement was patterned after the agreement between the Port of Seattle and Highline Community College. Hopefully it will meet with your approval. The agreement has been reviewed by the District's attorney and appears to be acceptable. If there are sections not acceptable to the Port, please contact me to discuss these issues.

Thank you for your cooperation and your patience.

Sincerely,

Jerry C. Heigh
Director, Facilities, Maintenance & Operations

JCH/dgb
encl.
c: Geri Fain

AGREEMENT

The parties to this Agreement are the Highline School District (DISTRICT) and the Port of Seattle (PORT). The District is generally bounded by Puget Sound on the west, Seattle City limits on the north, I-5/Military Road on the east, and 252nd Street South on the south and surrounds Seattle-Tacoma International Airport (AIRPORT). The Port is the owner-operator of the Airport.

WHEREAS, the District desires to decrease aircraft-generated noise levels within District facilities; and

WHEREAS, the Port desires to do the same as indicated in Port Commission Resolution No. 3125;

NOW, THEREFORE, in consideration of their mutual promises herein, the parties agree as follows:

1. (a) The School District waives all damages and claims for damages caused or alleged to be caused by or incidental to aircraft noise or noise associated conditions up to the base level (as hereinafter defined), for all buildings identified that receive Project Work (as hereinafter defined) with funds provided under this Agreement.

(b) As used herein, the term "aircraft" shall mean any and all types of aircraft, whether now in existence or hereafter developed or manufactured, and shall include, without limitation, jet aircraft, propeller-driven aircraft, civil aircraft, military aircraft, commercial aircraft, helicopters, and all other types of aircraft or vehicles now in existence or hereafter developed for the purpose of transporting persons or property through the air.

(c) As used herein, the term "base level" is determined by reference to either (i) yearly day-night average sound level based upon actual noise level monitored at the applicable School District site (using standard acceptable noise monitoring techniques), or (ii) the Port's 1991 FAA-approved Noise Exposure Map showing yearly day-night average sound level (as defined in 14 C.F.R. & 150.7 and 14 C.F.R. Part 150 App. A), whichever is higher. The base level for any particular School District site is determined at the average annual contour line that most closely bisects the middle of the applicable site. This base level shall not be deemed to be exceeded unless either (i) actual noise monitoring, or (ii) a Noise Exposure Map subsequently approved by the FAA, establishes that the DNL noise contour for any three-month period has increased by more than 1.5 db. If the base level is exceeded, this Agreement shall be voidable at the option of the School District.

2. The Port shall pay the District the estimated amount of $1,700,000.00, or such other amount as may subsequently be agreed by the parties, for noise-abatement project work ("Project Work") completed, under construction, or planned for construction at the "The New Beverly Park at Glendale Elementary School" site and the "Pacific Middle School" site, that is approved by the Port and is in compliance with FAA guidelines. The District waives claims hereunder only for buildings that receive Project Work.

3. The District shall be responsible for all design, testing, and completion of the Project Work, and will submit to the Port documentation of expenditures for reimbursement or payment. The Port shall promptly reimburse or pay all amounts that comply with this Agreement.

4. Port personnel may, after reasonable notice and at reasonable times, either during or after construction, enter on the District property to inspect any and all Project Work.

5. The School District shall maintain and not intentionally remove any of the Project Work, including materials and equipment, for which reimbursement or payment is made under this Agreement, unless equivalent or better noise abatement measures are substituted, or unless the needs of the School District require the removal of Project Work for the alteration or demolition of any building on which such Project Work has been undertaken.

6. This Agreement shall take effect on the date indicated below and remain effective during the existence of a benefiting building so long as the Airport is used for airport purposes. The Agreement shall bind all successors in right, title, or interest of each party.

7. This Agreement is the entire Agreement between the parties and shall not be modified except by a further written agreement.

Dated this _____ day of _____, 1994.

_____	_____
Executive Director Port of Seattle	Superintendent Highline School District
Approved as to form and confirming executor's authority:	Approved as to form and confirming executor's authority:
_____	_____
Senior Port Counsel	

Port of Seattle

August 17, 1994

Mr. Jerry Heigh
Director, Facilities, Maintenance & Operations
Highline Public Schools
18367 8th Avenue South
Seattle, Washington 98148

Dear Mr. Heigh:

Enclosed is a revised draft of the Agreement that you sent me on July 15. The following revisions are needed:

1. Several references to "School District" were changed to "District" as per the first sentence in the Agreement

2. "Aircraft" and related language was added to 1.(a) to more closely follow the intent of RCW 53.54.030 (3)

3. "Approved" was changed to "accepted" in 3.(a). The FAA does not "approve" maps, they only "accept" them.

4. "Currently" was added to 3.(a) so that if sometime in the future the FAA redefines YDNL, it will not change the actual pre-agreed base level.

5. "At intervals of one decibel" was added to 3.(a) as the officially accepted map is at intervals of 5 decibels, which is not detailed enough for our purposes.

6. "The base level ... for that site" was added so that we can have an agreed upon base level prior to any funding being given.

7. "This base level ... exceeded ... " was changed to allow the school district to use whatever means it sees fit to establish that the base level has been exceeded.

8. "voidable" has been changed as that is not acceptable to the Port. If the noise level increases, the work done for the existing level does not go away. The only "new" damages would be for noise levels that had not been treated, i.e. those above the "base level".

9. Wording in 2. was changed as it implies that we will pay for work that is planned but not performed. That is not the case. The less detailed wording as proposed in this revision will allow design work to be paid for as well as work underway or completed.

Seattle-Tacoma
International Airport
P.O. Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

After reviewing this revision, give me a call at 431-5915 and we can discuss further revisions.

Sincerely,

Earl Munday
Manager, Noise Remedy

enclosure: Agreement Draft 2

beigh/em

AGREEMENT

The parties to this agreement are the Highline School District (**DISTRICT**) and the Port of Seattle (**PORT**). The District is generally bounded by Puget Sound on the west, Seattle City limits on the north, I-5/Military Road on the east, and 252nd Street South on the south and surrounds Seattle-Tacoma International Airport (**AIRPORT**). The Port is the owner-operator of the Airport

WHEREAS, The District desires to decrease aircraft-generated noise levels within District facilities; and

WHEREAS, The Port desires to do the same as indicated in Port Commission Resolution No. 3125;

NOW, THEREFORE, in consideration of their mutual promises herein, the parties agree as follows:

1. (a) The District waives all damages and claims for damages caused or alleged to be caused by or incidental to the operation of aircraft, and for noise and noise associated conditions therewith, up to the base level (as hereinafter defined), for all buildings that receive Project Work (as hereinafter defined) with funds provided under this Agreement.

(b) As used herein, the term "aircraft" shall mean any and all types of aircraft, whether now in existence or hereafter developed or manufactured, and shall include, without limitation, jet aircraft, propeller-driven aircraft, civil aircraft, military aircraft, commercial aircraft, helicopters, and all other types of aircraft or vehicles now in existence or hereafter developed for the purpose of transporting persons or property through the air.

(c) As used herein, the term "base level" is determined by reference to either (i) yearly day-night average sound level based upon actual noise level monitored at the applicable School District site (using standard acceptable noise monitoring techniques), or (ii) the Port's 1991 Federal Aviation Administration (FAA) accepted Noise Exposure Map showing yearly day-night average sound level (YDNL, as currently defined in 14 C.F.R 150.7 and 14 C.F.R. Part 150 Appendix A), whichever is higher in contours at intervals of one decibel. The base level for any particular District site is determined at the average annual contour line that most closely bisects the middle of the site. The base level for a particular site will be determined and agreed upon in writing before any funds are paid to the District by the Port for that site. This base level shall not be deemed to be exceeded unless the College establishes that this annual noise contour has increased by more than 1.5 DNL. If the base level is exceeded, this Agreement shall remain in full force and effect as to all noise and noise associated conditions falling within the base level.

2. The Port shall pay the District the estimated amount of $1,700,000.00, or such other amount as may subsequently be agreed by the parties, for noise-abatement project work (Project Work) at the "New Beverly Park at Glendale Elementary School" site and the "Pacific Middle School" site, that is approved by the Port and is in compliance with FAA guidelines. The College waives claims hereunder only for buildings that receive Project Work.

3. The District shall be responsible for all design, testing, and completion of the Project Work, and will submit to the Port documentation of expenditures for reimbursement or payment. The Port shall promptly reimburse or pay all amounts that comply with this Agreement.

4. Port personnel may, after reasonable notice and at reasonable times, either during or after construction, enter on the District property to inspect any and all Project Work.

5. The District shall maintain and not intentionally remove any of the Project Work, including materials and equipment, for which reimbursement or payment is made under this Agreement, unless equivalent or better noise abatement measures are substituted, or unless the needs of the District require the removal of Project Work for the alteration or demolition of any building on which such Project Work has been undertaken.

6. This Agreement shall take effect on the date indicated below and remain effective during the existence of a benefiting building so long as the Airport is used for airport purposes. The Agreement shall bind all successors in right, title, or interest of each party.

7. This agreement is the entire agreement between the parties and shall not be modified except by a further written agreement.

Dated this ____ day of _____ 1994.

Executive Director Port of Seattle	Superintendent Highline School District
Approved as to form and confirming executor's authority:	Approved as to form and confirming executor's authority:
Senior Port Counsel	Highline School District Attorney

highline/em - draft 2 - 8/16/94

Port of Seattle

AGREEMENT

The parties to this agreement are the Highline Community College ("College") and the Port of Seattle ("Port"). The College is located at 2400 South 240th Street, Des Moines, Washington 98198-9800. The Port is the owner-operator of Seattle-Tacoma International Airport ("Airport").

WHEREAS, The College desires to decrease aircraft-generated noise levels within campus buildings; and

WHEREAS, The Port desires to do the same as indicated in Port Commission Resolution No. 3125;

NOW, THEREFORE, in consideration of their mutual promises herein, the parties agree as follows:

1. (a) The College waives all damages and claims for damages caused or alleged to be caused by or incidental to the use and passage of aircraft within navigable airspace, including those caused by noise or noise associated conditions up to the base level (as hereinafter defined), for all buildings identified in attachment A that receive noise treatment with funds provided under this Agreement.

(b) As used herein, the term "aircraft" shall mean any and all types of aircraft, whether now in existence or hereafter developed or manufactured, and shall include, without limitation, jet aircraft, propeller-driven aircraft, civil aircraft, military aircraft, commercial aircraft, helicopters, and all other types of aircraft or vehicles now in existence or hereafter developed for the purpose of transporting persons or property through the air.

(c) As used herein, the term "base level" is determined by reference to the Port's 1991 Federal Aviation Administration (FAA) accepted noise exposure map showing yearly day-night average sound level (YDNL, as currently defined in 14CFR 150.7 and Part 150 Appendix A) in contours at intervals of one decibel. The base level for the College is determined at the average annual contour line that most closely bisects the middle of its campus, which is 73 YDNL. This base level shall not be deemed to be exceeded unless the College establishes that this noise contour (or the YDNL at this point of the campus) has increased by more than 1.5 YDNL. Even if the base level is exceeded, this Agreement shall remain in full force and effect as to all noise and noise associated conditions falling within the base level.

2. The Port shall pay the college the estimated amount of $7.6 Million, or such other amount as may subsequently be agreed by the parties, for noise-abatement project work ("Project Work") on eligible College buildings as listed on Attachment A, that is approved by the Port and is in compliance with FAA guidelines. The College waives claims hereunder only for buildings that receive Project Work.

Seattle-Tacoma
International Airport
P.O. Box 68727
Seattle WA 98168 U.S.A.
TELEX 703473
FAX (206) 431-5912

3. The College shall be responsible for all design, testing, and completion of the Project Work, and will submit to the Port documentation of expenditures for reimbursement or payment. The Port shall promptly reimburse or pay all amounts that comply with this Agreement.

4. Port personnel may, after reasonable notice and at reasonable times, either during or after construction, enter on the College campus to inspect any and all Project Work.

5. The College shall maintain and not intentionally remove any of the Project Work, including materials and equipment, for which reimbursement or payment is made under this Agreement, unless equivalent or better noise abatement measures are substituted.

6. This Agreement shall take effect on the date indicated below and remain effective during the existence of a benefiting building so long as the Airport is used for airport purposes. The Agreement shall bind all successors in right, title, or interest of each party.

7. This agreement is the entire agreement between the parties and shall not be modified except by a further written agreement.

Dated this 5th day of April 1994.

Executive ~~Director~~
Port of Seattle

President
Highline Community College

Approved as to form and confirming executor's authority:

Senior Port Counsel

Approved as to form and confirming executor's authority:

Assistant Attorney General

Attachment A: Highline Community College Campus Buildings

1805N/em - 3/8/94

PORT 0003417

ATTACHMENT A

HIGHLINE COMMUNITY COLLEGE
CAMPUS BUILDINGS

Number	Use
1	Faculty Administration
2	Classrooms
3	Art Studio
4	Performing Arts
5	Faculty Offices
6	Student Services
7	Arts/Lecture
8	Student Center
9	Faculty Offices
10	Classrooms
11	Faculty Offices
12	Biology Lecture/Lab
13	Lecture Rooms
14	Chemistry & Physics Lecture/Lab
15	Faculty Offices
16	Print Shop Lab
17	Classrooms
18	Faculty Offices
18A	Child Care Center
18B	Child Care Center
19	Developmental Studies
20	Faculty Offices
21	Classrooms
21A	Student Counseling
22	Classrooms
23	Classrooms
24	Plant Operations
24A	Plant Operations
25	Library
26	Classrooms
27	Locker Rooms
28	Pavilion
28A	Weight Room
29	Swimming Pool
30	Instructional Computer Center

Appendix C

PORT 0003419

APPENDIX C

REVIEW OF RELEVANT STUDIES

APPENDIX C

SUMMARY REVIEW OF RELEVANT STUDIES

This appendix contains brief summaries of the available studies explicitly designed to measure the effects of changes in aircraft noise level on annoyance. It should be noted that none is directly comparable to the situation at Sea-Tac. All but one were studies of abrupt changes in noise level caused by changes in flight paths, opening of a new airport, or specific operations of a temporary nature at the airport. The sole study of a gradual change was of an increase in DNL during a period of increase in both operations and in the general public's knowledge of and experience with aircraft (1961-67). We have been unable to locate any properly-done surveys of annoyance changes as a result of gradual decreases in DNL.

Although no surveys presently exist specific to the Sea-Tac situation, several studies have been aimed at finding out whether people overreact or underreact in terms of annoyance to abrupt changes in noise level. Of these studies the results are mixed (see Chapter 3), and there seems no reason to expect more or less change than would be predicted by using the standard annoyance curves described in Chapter 3 (Fields, 1993).

Brief Summaries of Studies of Change

(1) *Fidell, S., Silvati, L. & Pearsons, K. (1995). Social survey of community response to noise exposure near Seattle-Tacoma International Airport. Report prepared for the Airport Communities Coalition by BBN Systems and Technologies, Canoga Park, CA.*

Fidell et al (1995) conducted a survey of annoyance at Sea-Tac Airport. We will first describe the results of this survey and then address the question of whether it adequately assessed the issue of changes in annoyance related to the noise reductions at Sea-Tac Airport. Note that since this survey was standard in terms of measuring present annoyance, and achieved results consistent with other such surveys, we believe the results relating to current annoyance levels to be valid and relevant to the present discussion, as indicated above.

Within the context of a standard survey that measured the current Percent Highly Annoyed (%HA) by aircraft noise, Fidell et al (1995) also asked several nonstandard questions designed to ascertain whether residents had noticed any changes in aircraft noise over the previous 1 or 2 years and whether their annoyance with such noise had changed. Specifically, they were asked: "Have you noticed any more or less aircraft noise in your neighborhood over the past year, just since last February?" and "How about the past two years? Have you noticed any more or less aircraft noise in your neighborhood over the past two years?" Yes answers to either of these questions were followed by questions about whether the noticed increase or decrease was slight, moderate or considerable. They also asked the following question about changes in annoyance: "Has your annoyance with

aircraft noise changed during the last two years?" followed by a question determining whether the change was an increase or a decrease. In response to the first question, 52.8 % of the respondents (across all areas surveyed) answered no, while 43.3 % answered yes (36.5 % who noticed an increase and 6.8 % who noticed a decrease). Responses to the second question had 71 % reporting noticing an increase in aircraft noise, 13.2 % reporting noticing a decrease, and 10.2 % reporting not noticing any change. Finally, 57.5 % of respondents reported no change in annoyance over the previous two years and 39.7 % reported a change (of these latter,76 % said their annoyance had increased and 20.5 % said it had decreased). Fidell et al (1995) concluded that these data do not support either the hypothesis that respondents had noticed a decrease in aircraft noise over the period queried or the hypothesis that annoyance with aircraft noise had decreased over that period. Both of these hypotheses would be reasonable ones in the context of a reduction in aircraft-attributed DNL.

There are several reasons to conclude that, although carefully done, the Fidell et al (1995) results on noticing change in noise and change in annoyance do not accurately portray changes in noise impacts around Sea-Tac Airport. First, the questions about noticing changes in aircraft noise are ambiguous in that they do not specify what aspect of aircraft noise is referred to. In usual annoyance surveys peoples' responses are related to DNL (as described above) when they are asked about aircraft noise "in general" and this makes sense since the intent is to ascertain the extent of annoyance with any aspect of the noise. DNL is an integrated noise measure that in a sense summarizes all aspects of noise exposure, including the number of overflights and the noise they cause.

Second, the question about change in annoyance does not really properly address the question of whether annoyance really changed at Sea-Tac. The Fidell et al (1995) question introduces a nonstandard aspect to annoyance questions, that of change. It assumes the existence of annoyance and asks about change in the existing annoyance. The lack of a standard question format renders the responses uncomparable to those to the standard questions (see Fields, 1993) for a discussion of annoyance question formats). Furthermore, there is no indication of the absolute level of annoyance of the respondent before or after the change. It is possible that all of the respondents who reported an increase in annoyance actually experienced relatively low levels of annoyance both before and after the change, while those who reported a decrease experienced a high level before and a lower level after. Those who noticed no change in annoyance could be experiencing a low, medium or high level.

Third, all change questions were referred to a one or a two year period previous to the survey date, which was in February, 1995. Over the previous year, February 1994 to February 1995, overall average DNL level measured at the various noise-monitoring sites around the Airport where essentially unchanged. Similarly, overall DNL changed by less than 1 dBA between February 1995 and the two years before. Thus, it would not be unexpected that a change was not noticed.

Finally and importantly, accurate answers to this question imply that people can recall a quantitative level of annoyance experienced at some earlier period and compare that with current annoyance level in a unbiased way. Again, given limitations on memory and cognition, this seems implausible. It is a very difficult task for an individual to reconstruct their memory as to how an integrated noise level has changed over a six year period when that change has occurred gradually. In responding to the change question, an individual can be greatly influenced by recent publicity or news information concerning the airport when reconstructing their memory of how noise was in the past.

(2) *Directorate of Operational Research and Analysis (1971). Aircraft noise in the neighborhood of London Heathrow Airport. DORA Report No. 7105. Dept. of Trade and Industry, London.*

A comparison was made of the results of annoyance surveys taken in the vicinity of Heathrow Airport in 1961 and in 1967. Over this 6-year period there was a gradual increase in the integrated noise level (3 dBA NNI) because of a large (22 to 48 aircraft per day for the resampled area within 10 miles of the Airport) increase in operations at the Airport. The average peak level of the noise did not change during this time. There was a "very slight" increase in overall annoyance from 1961 to 1967 but it was not statistically significant. During this time there was a significant decrease in the number of people within this area who were afraid of crashes and a significant increase in the number of people in the area who had flown. This survey, although done before annoyance questions and survey techniques became standardized, does indicate that under some circumstances increases in noise level caused by increases in operations with no increase in peak noise level can have little effect on annoyance. However, the conditions are not really comparable to those of Sea- Tac, where an increase in operations has been accompanied by a decrease in integrated noise level. Moreover, airplane travel is now very common and it is unlikely that changes in travel patterns accompanied the noise changes at Sea-Tac.

(3) *Fidell, S. & Jones, G. (1975). Effects of cessation of late-night flights on an airport community. Journal of Sound and Vibration, 42, 441-427.*

In spring 1973 flight paths were altered at Los Angeles International Airport so that night approaches (11 PM to 6 AM) were made over water instead of over populated land. Nighttime Leq decreased from about 75 dBA in a high-noise area before the abrupt change to about 50 dBA after the change, although DNL decreased less than 3 dB because of the small number of operations involved (about 50 per day fewer night approaches over the land). In this very well done survey, a panel sample (but with about 50% drop-outs) and a control sample were taken shortly before, shortly after, and one month after the change. Overall, annoyance did not change significantly in response to the noise level change. The authors speculated that one month may not have been long enough for respondents to notice a change in sleep patterns. In the light of recent sleep studies (Chapter 3), it is also possible

that there was minimal sleep disruption occurring before the noise change and the elimination of the night flights resulted insignificant difference to sleep patterns.

(4) *Francois, J. (1979). Les repercussions du bruit des avions sur l'equilibre des riverains des aeroports: etude longitudinal author de Roissy, 3eme phase. IFOP/ETMAR, Paris.*

Charles de Gaulle Airport near Roissy on the outskirts of Paris opened in 1974. Residents in the vicinity were surveyed shortly before, one year after and 3.5 years after the opening. The surveys had both a panel sample and a control sample. A parallel survey was taken at Orly Airport, which had been open for many years and where noise level and air traffic had increased gradually over several years. Annoyance was similar at Roissy in 1975 and 1977 and Orly in 1975 and annoyance data from the three studies tracked the same Schultz-type curve. Presumably annoyance increased from zero to the measured level at Roissy after the beginning of air operations there and assumed approximately the same level as that at Orly within a year. This is evidence in favor of the position that use of the Schultz-type curve is a good way to assess annoyance change with noise change in the absence of a specific survey.

(5) *Fidell, S., Horonjeff, R., Teffeteller, S. & Pearsons, K. (1981). Community sensitivity to changes in aircraft noise exposure. NASA CR-3490. Washington, D.C.*

Raw, G.J. & Griffiths, I.D. (1985). The effect of changes in aircraft noise exposure. Journal of Sound and Vibration, 101, 273-275.

As a results of runway repairs, operations were at first diverted and then stopped for a period in 1979-1980 at Burbank-Glendale-Pasadena Airport. Annoyance surveys were conducted before, during and after the repair process at several areas with different abrupt noise exposure changes. In neighborhood A, DNL decreased from 77 to about 59. In B it increased from 59 to 69. In C it decreased from 65 to 57. At D it increased from 61 to about 64.5. In all neighborhoods surveyed, %HA changed with noise exposure changes and extensive reanalysis and discussion of these data (eg Raw & Griffiths, 1985 et seq) resulted in the conclusion that the changes observed were consistent with those expected on the basis of a Schultz-type baseline curve.

(6) *Fidell, S., Mills, J., Teffeteller, S. & Pearsons, K. (1982). Community response to three noise abatement departure procedures at John Wayne Airport. Prepared for NASA by BBN Systems and Technologies, Canoga Park, CA.*

In the fall of 1981, jet departure profiles were changed at John Wayne Airport. Three different profiles were implemented, each for a 2-week period. The profile changes changed Lmax levels near the airport and also changed DNL by 1 to 2 dB, sometimes increasing it but usually decreasing it. Annoyance surveys were conducted in areas with varying noise exposure before any change and after 2 weeks under each profile. Annoyance

did not change appreciably. However, annoyance varied with the long-term noise exposure in a Schultz-curve-like way, although it was considerably higher than predicted by the Schultz curve.

(7) *Gjestland, T., Liasjo, K.H., Granoien, I. & Fields, J.M. (1990). Response to noise around Oslo Airport Fornebu. DELAB Report No. STF40 A90189.*

In the summer of 1989 air traffic at Oslo Airport Fornebu increased by about 7.4% because of closure of another nearby airport. Noise exposure abruptly changed by up to 10 dB in some areas although generally by less than 3 dB. Annoyance surveys were conducted shortly before the change and shortly before the Airport reverted to normal procedures. Percent Highly Annoyed was related to noise exposure in general, consistent with previous studies. Annoyance appeared to change in the areas with changes in noise exposure by about the amount predicted by the Schultz-like annoyance curve.

(8) *Gjestland, T., Granoien, I., Liasjo, K.H. & Bugge, J-J. (1994). Community response to noise from a short term military aircraft exercise. In Noise and Man '93: Noise as a Public Health Problem (Proceedings from the Sixth International Congress), Vol. 2, pp. 589-592. INRETS, Arcueil, France.*

Annoyance surveys were conducted before, during, and after a series of military aircraft exercises near Bodo Airport in 1992-93 and Trondheim Airport Vernes in Norway in 1990-91. Both panel and control samples were used at both airports. Noise exposure increased abruptly by about 6 dB at Bodo and by about 3 dB at Vernes during the exercises, which occurred from time to time at these airports and lasted about 2-3 weeks each time they occurred. Annoyance around both airports was related to noise exposure levels in a manner similar to the Schultz curve. It did not change significantly during the exercises when noise exposure changed temporarily.

PORT 0003426

Appendix D

APPENDIX D

PUBLIC INVOLVEMENT

APPENDIX D

Public and Information Access Methods

Introduction

As we have discussed throughout this paper, over the years the Port of Seattle has taken a very pro-active approach to community involvement. This section outlines the avenues currently available to citizens who need information concerning the Port's noise programs as well as the extensive public involvement that led up to the development of the programs that are currently in place. This information will speak for itself as to the great lengths the Port has gone to encourage public participation in the many planning processes.

Information Access

The Port of Seattle's Noise Abatement Office and Noise Remedy Office provide citizens access to information and offers citizens the ability to make complaints through a variety of measures.

Noise Abatement:

Noise Information Line: The Noise Information Line (NIL) can be accessed by callers 24 hours a day. They may either dial a local number or, if they reside outside of the local calling area, they may dial a toll free 800 number. Citizens who phone the NIL are provided several options from which to chose depending on their specific concerns. During regular office hours, callers may also be connected directly to Noise Abatement staff to discuss their concerns or receive information. Callers may also leave official complaints for staff to transcribe and document. In addition, a caller may request various types of information through the NIL. These types are listed below:

- *Flight Track Investigations*: Callers may request Noise Abatement staff to investigate a specific overflight or operation which may have caused them concern or seemed unusual. Staff will investigate the operation in question through the use of a computer system called the Airport Noise and Operations Monitoring System. By using radar data provided by the Federal Aviation Administration, this system enables staff to identify an aircraft in question using the information provided by the caller. This information is then conveyed to the caller by either mail or phone call.

- *Callbacks:* If an individual phones the NIL after regular office hours or is unable to reach Noise staff directly, they may request a call back. When these messages are transcribed and documented, the forms are distributed to professional noise staff for follow-up.

- *Informational Mailings and Transmittal Forms* Individualized letters or transmittal forms are developed and mailed in response to calls received on the NIL.

Sound Off: Sound-off is a monthly informal question and answer session in which citizens may receive demonstrations of the ANOMS equipment and speak one-on-one to Noise staff about their concerns.

Fact Sheets: Fact sheets were developed by the Noise Abatement staff in an effort to provide citizens information about Sea-Tac's noise programs and about aircraft monitoring activities. Following is a list of those fact sheets available through the Noise Abatement Office:

- Sea-Tac Noise Information Line
- The Mediation Project
- Airport Noise Reduction Programs
- The Noise Budget Program
- The Nighttime Limitations Program
- Ground Noise Control Programs
- Noise Abatement Procedures Program
- Flight Track Plots - for both turbojet and propeller aircraft

Mailing Lists: Information requests are distributed through various avenues. Some are listed below:

- *Noise Abatement Quarterly Report List:* Contains over 4,000 individuals who receive the quarterly noise abatement report. This report contains technical information about the noise programs and answers questions most commonly heard by noise staff during the quarter. This mailing list is also combined with the monthly Forum Newsletter mailing list.

- *Forum Newsletter:* This newsletter is distributed to over 27,000 households. The Newsletter contains information about Sea-Tac Airport activities and provides dates, times, and location information for upcoming public meetings.

Open House: The Noise Abatement Office hosts an open house at least once a year. Information about the open house is advertised in local newspapers as well as noted in the *Forum Newsletter.* The open house is designed to provide citizens an opportunity to question staff about a variety of aircraft noise issues and to gather information about their specific concerns.

Seattle-Tacoma Noise Advisory Committee (SNAC): SNAC was developed at the conclusion of the Noise Mediation Project as an oversight committee to monitor the implementation of the noise programs developed during Mediation. The committee members were former members of the technical Options Subcommittee and include representatives from the community, Airport Users, Federal Aviation Administration, Airlines, and Air Line Pilots Association. Meeting information is printed in the Forum Newsletter and all meetings are open to the public.

Noise Remedy Office

1. Insulation Hardship Committee: This committee is comprised of a group of citizens who listen to and rule on requests made by individuals wishing to be moved up the waiting list for insulation. Requests can be made by anyone on the application list, however, due to discussion of confidential information, these meetings are closed to the public.

2. Homeowner Briefings: These briefings are open to the public. Citizens who are at the top of the waiting list for insulation are specifically invited, however, anyone interested in receiving more information about the insulation process is welcome.

3. Public Buildings Advisory Committee: Committee meetings are open to the general public. Members of the committee are representatives from various public buildings (churches, schools, etc.). The purpose of this committee is to develop the procedures for insulating public buildings that are within the 65 DNL.

4. Contractor Briefings: These briefings are generally provided to individuals who are interested in becoming a Port of Seattle contractor to complete insulation projects. Contractors are advised of the process involved with becoming a POS contractor and advised of the administrative requirements.

5. Contractor Forums: These forums are open to the general public. They are usually held off site in connection with forums held by other agencies.

6. Open House: The Noise Remedy office holds an open house twice a year. Advertisements are placed in local newspapers and notices are provided in the *Forum Newsletter*. Anyone is welcome to attend. These open houses provide citizens an opportunity to learn more about the insulation process, who is eligible, and what steps need to be taken to get on the waiting list. In addition, Noise Remedy staff participate in Noise Abatement Open houses held in the Main Terminal of Sea-Tac Airport.

7. Front Desk: An article is placed in the *Forum Newsletter* notifying readers that a Noise Remedy staff person is available during regular business hours to answer questions or distribute information about the noise insulation program.

Mediation Agreement
Summary of Meetings and Public Involvement

A *total of 17 full Mediation Committee meetings* were held between November 1988 and March 1990. The Mediation Committee consisted of representatives from the Federal Aviation Administration, the Air Line Pilots Association, the Airlines (Air Transport Association, United Airlines, Alaska Airlines, Federal Express and Horizon Airlines), Airport Users, impacted communities, and the Port of Seattle.

A Community Coordinator was selected by the Community Caucus and paid for by the Port of Seattle to assist citizens with logistics for meetings, completing and distributing meeting summaries, and facilitating any subcaucus meetings that were held as part of the process.

A *total of 15 full community caucus* meetings were held. This caucus was comprised of the citizen members of the Mediation Committee and the designated alternates of all five geographic areas. In addition, each community subcaucus held meetings designed to discuss issues pertinent to their respective geographic areas.

- *Eastside Subcaucus: 22*
- *Part 150 Subcaucus: 17*
- *North/Northwest Subcaucus: 15*
- *South/Southwest Subcaucus: 17*

All of the *above 86 meetings* were attended by the Community Coordinator who completed meeting summaries as directed by the individual subcaucus members. With the exception of the Part 150 subcaucus, the Community Coordinator was also responsible for distributing the meeting summaries to each respective subcaucus. It is possible that more than the above subcaucus meetings were held, however, no records are available for these.

A *total of six groundrules subcommittee meetings* were held. Five of these meetings were conducted between January and May of 1989. The remaining meeting was held in January 1990. This subcommittee consisted of representatives from each caucus who were directed to develop groundrules by which the Mediation Committee and any subcommittee, developed as part of the mediation process, would operate.

A *total of 11 Public Involvement Subcommittee meetings* were held between 1989 and January 1990. These meetings were designed to develop an outreach program to be implemented by the Mediation Committee to various Community Council groups, citizens not already involved in the process, elected officials, and other government agencies. A *slideshow* was developed by the subcommittee for use in presenting the status and goals of the Mediation Agreement to the above groups. In addition, *a Speaker's Bureau* comprised of representatives from all caucuses was developed in an effort to provide additional avenues for disseminating information about

Mediation to interested parties. Members of the Speaker's Bureau were provided communication training prior to any presentations.

A *total of 21 Options Subcommittee meetings* were held between May 1989 and March 1990. These meetings consisted of representatives from each caucus who assisted the technical consultant in developing the details of the noise reduction programs.

At least *eight other subcommittees and work groups* were developed to discuss and resolve various issues related to the Mediation process. A *total of at least 22 meetings* were held between 1988 and 1990. In addition, other subcommittee or work group meetings may have been held, however, no records are available for these. These subcommittees and groups included:

- Mediator Selection Subcommittee
- Mediator Scope of Work Subcommittee
- Technical Services Subcommittee
- Community Coordinator Selection Subcommittee
- Speaker's Bureau Training Subcommittee
- Noise Remedy Work Group
- East Turn Work Group
- Noise Budget Work Group

A *total of 17 briefings* about the Mediation process and on-going work were given to elected officials.

The *Sea-Tac Noise Advisory Committee* (SNAC) was developed at the completion of the Mediation process and is comprised of citizens who were members of the Options Subcommittee. SNAC's charge is to monitor the implementation of the Mediation Agreement. They have met a *total of 32 times* since 1990.

Notices for all public meeting dates were announced in the *Forum Newsletter* at least one month prior to the meeting. In addition, notices, meetings summaries, and packets of information were *directly mailed to over 650 citizens* who comprised the negotiating teams of the five geographic community subcaucuses.

A *total of 51 articles* were printed in the *Forum Newsletter* updating readers on the status of the Mediation process and providing opportunities for involvement in the process. In addition, *35 meeting announcements* were printed in the *Forum Newsletter*. This Newsletter is distributed to over 27,000 citizens and community groups throughout the Puget Sound.

Eight Public Forums were held in February and March of 1990. These forums were held on Bainbridge Island, Vashon Island, two on the eastside, one in Federal Way, one in the Part 150 area, and two north of the Airport. In addition, *two open houses* were held in 1988 offering citizens an opportunity to get involved with the Mediation process and to question staff about noise programs. An *additional open house* was held in March 1991 at Tyee High School which provided the public an opportunity to speak to staff regarding the status of the Noise Mediation Agreement programs.

MEDIATION COMMITTEE AND SUBCAUCUS MEETINGS (1988 - 1990)

Mediation Committee:

1988	*1989*	*1990*
November	January	February
December	*February (2)	March
	March	
	April (2)	
	*May (2)	
	June	
	August	
	September	
	October	
	November	

Total: 17

*One of the February 1989 meetings was a consensus building workshop offered to anyone interested in developing negotiation skills.
*One of the May 1989 meetings was a panel of legal experts available to answer questions and provide information on the legal aspects of the mediation process.

Public Involvement Subcommittee: (Consisted of representatives from each caucus whose charge was to develop a strategy for disseminating information to elected officials and the general public.)

1989	1990
April	January
May (2)	
June (2)	
July	
August	
September	
October	
November	

Total: 11

Public Forums: (The public forums were highly publicized events offered to the public as an opportunity to provide written and oral comment on the Mediation process and ask questions of members in each subcaucus.)

February 1990 (3):	Bainbridge, Federal Way, Seattle
March 1990 (5):	Eastside, Vashon Island, Maywood School, Bellevue Community College, Mercer Middle School
August 17, 1988:	Open House held at Boulevard Park Presbyterian Church. Provided an opportunity for citizens to talk one-on-one with Port and Federal Aviation Administration staff about Sea-Tac's noise programs, airport planning activities and air traffic topics.
August 18, 1988:	Open House held at the Port of Seattle Field Office, Maywood School. Provided an opportunity for citizens to talk one-on-one with Port and Federal Aviation Administration staff about Sea-Tac's noise programs, airport planning activities and air traffic topics.
March 1991:	Open House held at Tyee High School to allow the public to speak to staff regarding the status of the Noise Mediation Agreement programs, various planning programs, and the Flight Plan Project.

Briefings to Elected Officials:

Date	*Elected Official*
December 7, 1989	Representative Rod Chandler
December 8, 1989	Representative Jim McDermott
December 14, 1989	Seattle City Council
December 18, 1989	Kris Wilder (Senator Slade Gorton's Office)
January 4, 1990	Port of Seattle Commission
January 5, 1990	Jim Gunsolus (Senator Adam's office)
February 23, 1990	Seattle City Council
February 28, 1990	Eastside Elected Officials
March 2, 1990	Mailing to Interested Elected Officials describing the Mediation process
March 15, 1990	Mayor of Issaquah
March 29, 1990	Seattle Times
April 3, 1990	Seattle City Council Committee
April 5, 1990	Port of Seattle Commission
April 11, 1990	Seattle PI
April 19, 1990	Suburban Elected Officials
April 23, 1990	Executive Session of the Seattle City Council
May 8, 1990	Port of Seattle Commission

Total: 17

Community Subcaucus:

Eastside	*Part150*	*N/NW*	*S/SW*	**Community Caucus*
March 1989 (3)	March 1989 (2)	March 1989 (2)	March 1989 (2)	February 1989
April 1989	April 1989	April 1989	April 1989	March 1989
May 1989 (2)	May 1989	May 1989	May 1989 (2)	April 1989 (2)
June 1989 (2)	June 1989 (2)	June 1989	June 1989 (2)	May 1989
July 1989	July 1989	July 1989	July 1989	June 1989 (2)
August 1989 (2)	August 1989	August 1989 (2)	August 1989 (2)	July 1989
September 1989	September 1989	September 1989	September 1989	August 1989
October 1989	October 1989	October 1989	October 1989	October 1989
November 1989	November 1989	November 1989	November 1989	November 1989 (2)
December 1989	December 1989		December 1989	
January 1990 (2)	January 1990	January 1990	January 1990	January 1990
February 1990 (2)	February 1990	February 1990	February 1990	February 1990 (2)
March 1990 (3)	March 1990 (3)	March 1990 (2)	March 1990	

Total: 86

*Note: The Community Caucus consisted of the citizen Mediation Committee members and their alternates from all five geographic subcaucus represented in Mediation.

***Forum Newsletter* Articles Providing Updates and Information About Mediation:**

1988	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*
	January	January	January		January	January	January
February	February	February	February				
	March	March	March	March			
	April	April	April		April		
	May	May*	May/June	May	May	May	
	June	June					June
July/August	July/August	July	July	July	July	July	
August	September	August		August			September
	October	October		October	October		
		November	November	November			
December	December	December		December		December	

Total: 51

***Special *Forum Newsletter* devoted to Mediation**

Mediation Committee and Sea-Tac Noise Advisory Committee Meeting Announcements in the *Forum Newsletter*:

1988	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*
		January	January		January	January	January
		February	February				
	March	March		March	March	March	March
	April						
	May		May/June				May
	June				June		June
	July/August			July			July
							August
			September	September	September	September	September
	October			October			
	November	November*	December		November		

Total: 35

*Note: Beginning in November 1990, meeting announcements pertained to the Sea-Tac Noise Advisory Committee meetings. Beginning in May 1995, announcements for the Sound-Off program were provided in the Forum Newsletter. Sound-Off is designed to bring citizens into the Noise Abatement Office to discuss noise related issues.

Groundrules Subcommittee: (Consisted of representatives from each subcaucus whose charge was to develop groundrules by which the Mediation Committee and any subcommittee developed as part of the Mediation Process would operate.)

1989	*1990*
January 1989 (2)	January 1990
February 1989	
March 1989 (2)	
May 1989	

Total: 8

Options Subcommittee: (Consisted of representatives from each subcaucus whose charge was to assist in the development and completion of the technical programs in the Mediation Agreement agreed to by the full Mediation Committee.)

1989	*1990*
May	January 1990 (2)
June (3)	February 1990 (3)
July	March 1990 (3)
August (2)	
September (2)	
October (3)	
*November	

Total: 21

*Note: The November 1989 Options Subcommittee meeting was a briefing presented by the Federal Aviation Administration on the proposed 4-Post Plan.

Other Subcommittee and Work Groups: (Developed to address specific issues arising from the Mediation Process)

Mediator Selection	*Mediator Scope of Work*	*Technical Services*	*Community Coordinator Selection*
November 1988	January 1989	February 1989	February 1989
December 1988	June 1989	March 1989 (2)	March 1989 (2)
	November 1989	April 1989	April 1989 (2)

Speakers Bureau Training	*Noise Remedy Work Group*	*East Turn Work Group*	*Noise Budget Work Group*
October 1989	February 1990 (2)	March 1990	February 1990 (2)
		April 1990 (2)	

Total (Other): 22

Sea-Tac Noise Advisory Committee:

1990	*1991*	*1992*	*1993*	*1994*	*1995*
June	January (2)	February	January	January	January
July	May ?	April	March	March	March
August	June	May (Special)	June	April	June
September	September	July	September (2)	June	September
October	December	October	November	September	
November					

Total: 32

Date	*Item*
January 10, 1989	Status Report on the Mediation Process Requested approval of POS representatives to the Committee
February 14, 1989	Request for authorization for funds and to execute a contract with Mediators
May 23, 1989	Request for authorization for execution of a contract with Weslin Consulting Services for Community Coordination Services for Airport Noise Mediation Project
August 22, 1989	Briefing to Port Commissioners on status of the noise mediation project
May 8, 1990	First and Second Reading of Resolution 3062 endorsing the agreement of the Seattle-Tacoma International Airport Noise Mediation Committee and authorizing the Executive Director to take all necessary action to fulfill the terms of the agreement.
February 26, 1991	Status Report on the Implementation of the Noise Mediation Programs
June 22, 1993	Request for Port Commission to reconfirm the existing members of the Sea-Tac Noise Advisory Committee to serve an additional term and to confirm new alternate members as nominated by the Committee.

The Flight Plan Project
PSATC Public Involvement Summary

An important component of the Puget Sound Air Transportation Committee's (PSATC) Mission Statement was to develop regional consensus by involving citizens in the Flight Plan Project. A wide variety of means were used to keep citizens informed and involved. All PSATC meetings were open to the public and provided time for public comment. The following is a summary of the Flight Plan public involvement process.

Public outreach activities of the PSATC were guided by the *Public Involvement Subcommittee* which was chaired by Dr. Martin Neeb, Director of the School of Communications at Pacific Lutheran University.

A full-time *Public Involvement Coordinator* was employed to assist with the outreach and to be available to answer citizen questions and concerns in person, by phone, and in writing.

Six Public Open Houses and Scoping Meetings were held throughout the region during November 1990 to inform citizens and elected officials about the project and to provide them the opportunity to comment on the system alternatives and site options being considered and to help identify the types of environmental impacts to be examined in the EIS.

Four Public Meetings were held in March and April of 1991 to allow citizens to comment on the draft list of feasible alternatives developed by the PSATC's Options Subcommittee. Over 150 people testified at the meetings and over 200 written comments were received.

Eleven Public Hearings on the PSATC's Draft Recommendations and on the Draft EIS were held during January, February, and March of 1992 in King, Snohomish, Pierce, Kitsap, and Thurston Counties. Over 4,300 people attended with nearly 650 given testimony. In addition, over 2,100 written comments were received during an extended 75-day public comment period. All written comments, along with verbatim transcripts of the hearings, were made available to each member of the PSATC.

Eight Project Newsletters were distributed to a mailing list of more than 4,000 citizens, community leaders, local and state elected officials, and the news media. Newsletters discussed major project milestones, important study findings, and announced upcoming meetings. The two newsletters which summarized the PSATC draft and final recommendations were sent to an expanded mailing list of more than 30,000 people.

Two Slideshows were produced which discussed the nature of our region's air capacity problem and the alternatives being explored. Staff presented the slideshows and distributed project literature at Project Briefings with numerous community groups and civic clubs, local and state elected officials, and the media.

Press Releases were distributed to newspapers, radio and TV stations announcing PSATC meetings, Flight Plan finding, availability of project reports, and how citizens could comment on the project. In addition, two Media Brown Bag Lunches were held in which staff met with reporters to provide detailed technical information and to answer questions.

Legal Notices concerning the need to prepare an Environmental Impact Statement, the times and places for scoping meetings, the availability of the Draft EIS, and the times and places for public hearings were published in the region's major newspapers.

Two Focus Groups were conducted, one at the beginning of the project and one in the middle, in order to provide the PSATC with an in-depth and candid sample of public concerns and attitudes.

A *Public Opinion Survey* was conducted in December 1990 to gain a representative sample of public opinion concerning our region's air transportation system.

A *Newspaper Supplement* which outlined the Flight Plan Project, discussed the PSATC's draft recommendations, and announced the availability of the Draft EIS and how and where to comment was distributed to 860,000 newspaper subscribers throughout King, Snohomish, Pierce, Kitsap, and Thurston Counties.

PUGET SOUND AIR TRANSPORTATION COMMITTEE (FLIGHT PLAN):

Regular Meetings:

1989	*1990*	*1991*	*1992*
December	January	January	March
	February	February	June
	March	March	
	April	May	
	May	June	
	June	July	
	July	August	
	September	September	
	October	October (2)	
	November	November (2)	
		December	

Total: 26

PSATC Public Involvement:

October 1989:	Focus group conducted to gather public opinions
March 1990:	First Project Newsletter mailed (list of more than 4,000 people)
June 1990:	Second Project Newsletter mailed
October 1990:	Third Project Newsletter mailed
November 1990:	Six Public Open Houses and Scoping Meetings held throughout region to explain project, solicit comments
December 1990:	Survey conducted to gain a representative sample of public opinions concerning our region's air transportation system
February 1991:	Fourth Project Newsletter mailed
March-April 1991:	Four Public Meetings held to solicit comments on draft list of feasible alternatives
August 1991:	Fifth Project Newsletter mailed
September 1991:	Focus group conducted to gather public opinions
December 1991:	Sixth Project Newsletter mailed
January 1992:	Newspaper supplement outlining Flight Plan project and recommendations distributed to 860,000 newspaper subscribers throughout region
Jan. - March 1992:	Eleven Public Hearing held on draft recommendations and draft EIS
June 1992:	Seventh Project Newsletter mailed
July 1992:	Eight Project Newsletter mailed

In addition, PSATC issued regular news releases and held numerous project briefings with interested groups throughout the process.

Forum Newsletter Articles:

1990	*1991*
January	February
April	April

PSATC Special Topical Briefings/Other:

February 1991: Airport Capacity/Delay Workshop at Federal Aviation Administration
September 1991: Boeing Field/Sea-Tac Airspace Interaction Briefing
September 1991: Airport site tours
November 1991: General Aviation Community Briefing

PSATC EIS Scoping Meetings/Public Open Houses:

November 1990	Bremerton
November 1990	Tacoma
November 1990	Everett (Paine Field)
November 1990	Tacoma
November 1990	Sea-Tac Airport
November 1990	Seattle

Total: 6

PSATC Meetings to Gather Comments on the Draft Recommendations:

January 27, 1992	Bremerton
January 28, 1992	Tacoma
February 1, 1992	Everett
February 3, 1992	Tacoma
February 5, 1992	Lacey
February 6, 1992	Seattle
February 12, 1992	Arlington
February 13, 1992	Sea-Tac
March 12, 1992	Everett
March 17, 1992	Federal Way
March 19, 1992	Tumwater

Total: 11

PSATC Options subcommittee Regular Meetings:

1990	*1991*
September (2)	January
October (2)	February (2)
November (2)	March
	April
	May

Total: 8

Options subcommittee Public Meetings to Gather Comments on Draft Recommendations of Alternatives to Study Further in Phase III:

April 1991 (2)
May 1991 (2)

PSATC Public Involvement Subcommittee:

July 1990
August 1990
(Other Subcommittee meetings may have been held, no records found for these.)

PSATC Objectives and Evaluations Subcommittee:

June 1990 (2)
August 1990
(Other Subcommittee meetings may have been held, no records found for these.)

PSATC Forecast Subcommittee:

March 1990
May 1990
December 1990
(Other Subcommittee meetings may have been held, no records found for these.)

Commission Briefings and Presentation of Resolution No. 3125 for adoption:

September 19, 1992:	Brief Review
October 20, 1992:	Public Hearing
October 27, 1992:	First Reading
November 3, 1992:	Adoption of Resolution No. 3125

PART 150 UPDATE

Technical Review Committee: (This committee was comprised of representatives from the community, local and federal government, the Airport and airport users to provide input on the Update.)

Date	*Meeting Agenda*
June 1991	Purpose of Study & Committee, Schedule, Presentation on how airport noise is measured and described, data from Sea-Tac used in Study
July 1991	Review of Political Jurisdictions, explanation of forecast information used in 1995 and 2000 contours, preview of draft contours and discussion of implications, mobile home briefing
August 1991	1990 Contours and Land use and population analysis
October 1991	Review 1990 land use map and revised forecasts.
December 1991	Questions discussed regarding noise and input into the noise model
January 1992	1996 Noise Exposure Map, Land Use and Population Analysis, comparison of existing and future (1996) Noise Exposure Maps, Schedule
February 1992	Updated population and land use data for the Noise Exposure Maps, Comparison between 1991 and 1996 maps, Explanation of Phase 2 of this project, Noise Compatibility Program amendments, review of the Noise Mediation Project, Explanation of the Noise Compatibility Program amendments from the Noise Mediation Project, Schedule
April 1992	Review of Open House and Public Comments, Mobile Home Recommendations, Review of the Public Buildings Committee work
September 1992	Noise Exposure Map status, Review of TRC recommendations to date, Amendments to the Compatibility Plan, Summary of Remaining Work
November 1992	Review summary of recent Port Commission meetings related to the Noise Remedy Program, Presentation on Highline Public Schools from school official, federal grant process review, 1996 NEMs Variance Review
December 1992	Federal Grant Process, 1996 NEM revisions, Draft NCP amendments, review schedule, Sea-Tac Communities Plan optional briefing
January 1993	Review Part 150 amendments to the Noise Compatibility Program
April 1993	Collect final comments on the Part 150 amendments prior to public hearing

Total: 13

Forum Newsletter Articles and Notices for Meetings:

Articles	*Meeting Announcements*
July 1991	August 1991
September 1991	October 1991
	November 1991
	December 1991
	January 1992
March 1992	March 1992
April 1992	April 1992
June 1992	
	November 1992
April 1992	April 1992
May 1992	May 1992
Total: 7	Total: 10

April 8, 1992: Open House held at Tyee High School to review the draft noise exposure maps, ask questions, and give comments to the Port of Seattle for consideration in updating the maps under the Federal Aviation Regulation Part 150. (100 attended)

May 12, 1993: An Open House and Public Hearing was held at the Highline Performing Arts Center. Both events provided citizens an opportunity to comment on the proposed amendments to the Sea-Tac Airport Part 150 Noise Compatibility Program. Citizens were able to view exhibits related to the amendments and discuss them with Port Noise Remedy and Noise Abatement staff.

Port of Seattle Commission Meetings:

June 22, 1993 Resolution No. 3144, First Reading. To request Port Commission adoption of 1993 Amendments to Sea-Tac International Airport Federal Aviation Regulation Part 150 Noise Remedy Program as adopted by Port Commission Resolution No. 2943 as amended.

June 29, 1993 Resolution No. 3144, Second Reading and Final Passage. Adoption of 1993 Amendments to Sea-Tac International Airport Federal Aviation Regulation part 150 Noise Remedy Program as adopted by Port Commission Resolution No. 2943 as amended.

September 9, 1994 Noise Remedy Program Briefing on the Insulation Priorities and Program Status Report at Seattle-Tacoma International Airport.

MASTER PLAN UPDATE
PUBLIC INVOLVEMENT AND MEETING SUMMARY

Public Outreach Efforts for the Master Plan Draft Environmental Impact on April 27, 1995

- Press release to all major area media in Western Washington
- Newsflash (like a press release) to 60 elected officials of King County
- Forum Newsletter to 27,000 homeowners
- Letter, Forum and groundrules about public hearing to 1,200 people on special mailing list
- Forum to 1,200 Port employees
- Internal Message System (IMS) to Port Employees
- Executive summaries to councilmembers and city managers of SeaTac, Des Moines, Burien, Tukwila, Normandy Park, and Federal Way
- Federal Aviation Administration consultant sent full DEISs to each of the six Airport cities, RCAA, ACC, member cities and Highline School District, Congressmembers Randy Tate, Jennifer Dun and Jim McDermott, King County Executive Gary Locke, Seattle Mayor Norm Rice, Pierce County Executive Doug Sutherland, state legislators of 33 legislative districts (airport area), Washington Public Port Association, and other interested state and federal agencies.

MASTER PLAN UPDATE

Sea-Tac University: (A series of informal meetings designed to help people better understand the details of operating and planning at the airport.)

Date	*Topic*
May 17, 1994	*What is this Master Plan Process all about, anyway?*
May 26, 1994	*Marketplace Realities: Demand and Demand Management*
June 8, 1994	*An Insider's View of the Airfield: What's Happening Now?* Presentation of the pros and cons of all options being considered including what will happen at Sea-Tac if no runway was built.
June 16, 1994	*An insider's view of the Airfield: What's Happening Now?* Presentation of costs of various options and the benefits/costs of each of the proposals.
June 22, 1994	*On the Road Again... Handling Traffic Options Under the Master Plan:* Featured a panel of speakers who provided an overview of the planning activities, analyses, and resulting recommendations regarding traffic control that have been conducted over the past several years. Traffic analyses also presented and placed in context with other traffic study work that has been done in the area.
July 12, 1994	*On the Road Again... Handling Traffic Options under the Master Plan:* Consultant team staff presented the options being considered to handle traffic and parking at the Airport. Meeting attendees were provided opportunities to discuss the configurations with panel members.
September 21, 1994	*Trains and Boats and Planes... A Look at Different Ways of Traveling* Consultants discussed the feasible options for Sea-Tac Airport and potential links fore these options throughout the Puget Sound region.
October 4, 1994	*What About All That Other Land? A Discussion Of Potential Development Around the Airport.* A meeting focusing on land use, the possibilities for new development, and the decision-making process related to those parcels of land.
October 20, 1994	*A Time for Review: Community Meeting* Airport staff were available to discuss comments and to review the next steps of the Master Plan Update Process.

Each Sea-Tac University was video taped and aired on public television several time a week between June 1994 and January 1995.

Technical Advisory Committee Meetings (MPU):

July 1994
March 1995
April 1995
May 1995

Forum Newsletters **Articles and Meeting Announcements:**

Articles	*Meeting Announcements*
January 1994	January 1994
February 1994	February 1994
March 1994	
April 1994	
August 1994	
September 1994	
October 1994	
November 1994	
December 1994	
January 1995	
April 1995	April 1995
May 1995	May 1995
	June 1995
July 1995	July 1995
	August 1995
September 1995	

Total: 14 Total: 7

Master Plan Update Presentations to Port of Seattle Commissioners:

1993	*1994*	*1995*
March 1	January 10	February 13
October 4	May 9	August 7
	September 12	
	September 27	

Total: 8

SOUTH ACCESS SUPPORT AREA

Fall 1991: Scoping Meetings

March 24, 1992: Draft EIS public briefing to SeaTac City Council/Planning Commission

April 9, 1992: Public Hearing on Draft EIS

Date	*Group or Agency*
December 20, 1991	City of Des Moines staff
January 22, 1992	Angle Lake Community Council
January 29, 1992	Airline Technical Committee
January 15, 1992	Boulevard Park Community Council
January 17, 1992	SW King County Chamber of Commerce
January 21, 1992	South Access Executive Committee
January 21, 1992	Trout Unlimited
January 27, 1992	SeaTac Planning Commission
January 30, 1992	SeaTac Community Council
January 31, 1992	Normandy Park staff
February 6, 1992	City of Des Moines Council
February 5, 1992	Highline Community Council
February 4, 1992	Mobile Home residents
February 25, 1992	Normandy Park Council
February 28, 1992	South Access Advisory Committee
March 24, 1992	SeaTac City Council

Total: 16

NOISE REMEDY INFORMATIONAL MEETINGS

Insulation Hardship Committee:

1990	*1991*	*1992*	*1993*	*1994*	*1995*
April	March	March	September	February	March
October	June	June	November	May	July
	September	November		September	

Total: 15

Dinners: May 1992; March 1994

Public Buildings Advisory Committee:

1990	*1991*	*1992*	*1993*	*1994*
January	June	May	April	May
February		July		June
May		September		August (?)
July		November		October (?)
August		December		
December				

Total: 17

Homeowner Briefings:

1990	*1991*	*1992*	*1993*	*1994*	*1995*
January	January (2)	January (2)	January (2)	January (4)	January (7)
February	February (2)	February (2)	February (2)	February (5)	February (7)
March	March (2)	March (2)	March (2)	March (5)	March (7)
April	April (2)	April (2)	April (2)	April (5)	April (7)
May	May (2)	May (2)	May (2)	May (6)	May (7)
June	June (2)	June (2)	June	June (6)	June (7)
July	July (2)	July (2)	July	July (6)	July (6)
August	August (2)	August (2)		August (6)	August (6)
September	September (2)	September (2)	September (2)	September (7)	
October	October (2)	October (2)	October (3)	October (6)	
November	November (2)	November (2)	November (4)	November (7)	
December	December		December (2)	December (7)	

Total: 204

NOISE REMEDY INFORMATIONAL MEETINGS (con't)

Open Houses (at Maywood)

March 1990 (2)
April 1994
June 1995

Contractor Briefings:

1990	*1991*	*1992*	*1993*
August	March	February	May
	July	July	December

Total: 7

Contractor Forums:

January 1992
May 1993
April 1995

Airport Briefings by Airport Staff to Various Groups:

Date	*Group*	*Title/Subject*	*Size*
April 1995	Des Moines Vista Retirement	General Overview/Airport Update	30
October 1994	City of Burien Staff Meeting	General Airport Update	2
December 1994	Highland Park School	General Airport	60
January 1994	Juan Cotto, KC Exec Office	Air Capacity	1
April 1994	Sea-Tac City Managers	Master Plan Update (MPU)	12
May 1994	New Burien City Cnclmbrs Briefing	Airport, MPU, & Economic Impact	3
May 1994	Presentation to Port Commission	MPU & Public Involvement	10
October 1994	Sea-Tac Business Committee	MPU	5
October 1995	Owners of Local Hotels	MPU	2
July 1994	Federal Way Rotary Club	3rd Runway	40
July 1994	Kirkland Kiwanis Sunrisers	3rd Runway	25
August 1994	Seattle Industrial Rotary Club	3rd Runway	30
August 1994	Lake Forest Rotary Club	3rd Runway	25
September 1994	Northwest Ethics Institute	3rd Runway	45
October 1994	Kirkland Kiwanis	3rd Runway	60
December 1994	The Retired Men's Club	3rd Runway	20
January 1995	Kent Chamber of Commerce	3rd Runway	10
February 1995	Bellevue Lions	3rd Runway	20
January 1994	Sea-Tac City Council	Noise Abatement & Insulation Brfg	30
June 1994	King County Council	Noise Abatement & Insulation Brfg	30
August 1994	PSRC	Noise Abatement & Insulation Brfg	100
May 1994	King County Council	Airport Issues Briefings	
1994	Various Groups	Airport Noise and Operating System Demonstration (ANOMS)	607
1995	Various Groups	ANOMS	292
January 1994	Port of Portland Aviation	MPU	5
March 1994	State Trans. Commissioner Thompson	Air Capacity Planning Update	1
April 1994	Renne Fennes Netherlands Air Plcy Officer	Air Capacity Planning Update	1
May 1994	State Trans. Commission Thompson	Air Capacity Planning Update	1
May 1994	Burien City Managers and Council	Air Capacity Planning Update	8
June 1994	Legislative Briefing - County Council	Air Capacity Planning Update	5
July 1994	EDC Meeting	Air Capacity Planning Update	25
July 1994	Gary Locke w/Patricia Davis	Air Capacity Planning Update	3
July 1994	Moscow Aviation Management Delegation	Air Capacity Planning Update	10
August 1994	Thailand Port Authority	Air Capacity Planning Update	14
August 1994	PSRC Executive Board	Air Capacity Planning Update	50
September 1994	Washington Airport Management Association	Air Capacity Planning Update	25
September 1994	Presentation to Public & Port Com	Resolution 3125 Update	35
October 1994	SW King County Chamber, Bus Com	Air Capacity Planning Update	10
February 1995	Kuan Cotto County Executive	MPU	1

Airport Briefings by Airport Staff to Various Groups (continued):

Date	*Group*	*Title/Subject*	*Size*
March 1995	Presentation to Public & Port Comsnr	Resolution 3125 Update	30
March 1995	Sea-Tac Planning Commission	Terminal Options	10
March 1995	Federal Way Chamber of Commerce	Air Capacity Planning Update	8
March 1995	Tridec Luncheon	Air Capacity Planning Update	160
April 1995	Glen Acres Condo Association	Airport Noise Issues	4
April 1995	Spokane City Delegation	Master Plan and Air Capacity	10
November 1994	Mercer Island Kiwanis	Airport Development Projects	20
March 1994	Exchange Club of Highline	Airport Capacity Expansion Planning	10
May 1994	Sea-Tac Air Traffic Controllers	Airport Capacity Expansion Planning	20
July 1994	PSRC Regional Technical Committee		50
August 1994	AAAE Noise Conference	Airport Capacity Expansion Planning	30
September 1994	King County Planning Division	Airport Capacity Expansion Planning	5
September 1994	FAA Staff	Airport Capacity Expansion Planning	20
January 1995	Stadium Kiwanis	Airport Capacity Expansion Planning	25
February 1995	Magnolia Community Club	Airport Capacity Expansion Planning	10
April 1995	Sea-Tac Westside Subarea Planning Committee	Airport Capacity Expansion Planning	10
April 1995	North Sea-Tac Citizens Organization	Airport Capacity Expansion Planning	25
April 1995	Renton Rotary	Airport Capacity Expansion Planning	
April 1995	Renton Rotary	Sea-Tac Development	75
February 1995	Magnolia Community Club	Panel: "Aircraft Overflight Noise"	30
		Total	**2205**