

**Metropolitan Transportation Commission**  
**Regional Airport System Planning Analysis Update**  
**Noise Technical Report**

HMMH Report No 303890  
July 2010

Prepared for:

**SH&E**  
One Main Street  
Cambridge, MA 02142



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## Contents

<b>1</b>	<b>Introduction</b> .....	<b>1</b>
<b>2</b>	<b>Noise Modeling Methodology</b> .....	<b>3</b>
2.1	Comparing Airport Operations Using the Area Equivalent Method .....	3
2.2	Generating Noise Contours with NMPlot .....	3
<b>3</b>	<b>Population Impact Analysis Methodology</b> .....	<b>5</b>
<b>4</b>	<b>Noise Modeling Results</b> .....	<b>7</b>
4.1	Results .....	7
4.2	Effects of Changes in Noise and Population Growth .....	8
4.3	Noise Contributors .....	10
4.3.1	2035 Baseline Compared to 2007 Existing .....	10
4.3.2	2035 Alternative Scenarios Compared to 2035 Baseline .....	11
<b>Appendix A</b>	<b>Aircraft Operations Tables</b> .....	<b>15</b>
<b>Appendix B</b>	<b>Aircraft Noise Terminology</b> .....	<b>62</b>
B.1	Introduction to Acoustics and Aircraft Noise Terminology .....	62
B.1.1	Decibel, dB .....	62
B.1.2	A-Weighted dB .....	63
B.1.3	Maximum sound level, Lmax and Time Above, TA .....	65
B.1.4	Time Above, TA .....	65
B.1.5	Sound Exposure Level, SEL .....	65
B.1.6	Equivalent Sound Level, Leq .....	66
B.1.7	Community Noise Equivalent Level, CNEL .....	67

## List of Figures

Figure 1	United States Census Tract and Blocks .....	5
Figure 2	Common A-weighted environmental sound levels .....	64
Figure 3	Variation of A-weighted sound level over time .....	65
Figure 4	Graphic display of Sound Exposure Level, SEL .....	66
Figure 5	Graphical display of a one-minute Equivalent Sound Level, Leq .....	67
Figure 6	Sound level fluctuation and noise dose .....	68

## List of Tables

Table 1 Residential Population within the 65 dB CNEL Contour by Airport and Analysis Scenario .....	7
Table 2 Residential Population within the 55 dB CNEL Contour by Airport and Analysis Scenario .....	8
Table 3 2007 Residential Population within the 65 dB CNEL Contour by Airport and Analysis Scenario .....	8
Table 4 2007 Residential Population within the 55 dB CNEL Contour by Airport and Analysis Scenario .....	9
Table 5 Comparison of Noise Effects and Population Growth Effects for the 2035 Baseline Scenario – 65 dB CNEL	9
Table 6 Comparison of Noise Effects and Population Growth Effects for the 2035 Baseline Scenario – 55 dB CNEL	9
Table 7 Distribution of 2007 Existing and 2035 Baseline Operations.....	10
Table 8 Distribution of 2035 Baseline and Alternative Scenarios Operations .....	11
Table 9 AEM Aircraft Type Assignments .....	16
Table 10 OAK 2007 Existing Average Daily Landing &Takeoff Cycles .....	22
Table 11 OAK 2035 Baseline Average Daily Landing &Takeoff Cycles.....	25
Table 12 OAK 2035 Redistribution Average Daily Landing &Takeoff Cycles .....	26
Table 13 OAK 2035 Internal Regional Airports Average Daily Landing &Takeoff Cycles.....	27
Table 14 OAK 2035 External Regional Airports Average Daily Landing &Takeoff Cycles.....	28
Table 15 OAK 2035 Air Traffic Control Average Daily Landing &Takeoff Cycles .....	29
Table 16 OAK 2035 High Speed Rail Average Daily Landing &Takeoff Cycles .....	30
Table 17 SFO 2007 Existing Average Daily Landing &Takeoff Cycles.....	31
Table 18 SFO 2035 Baseline Average Daily Landing &Takeoff Cycles .....	33
Table 19 SFO 2035 Redistribution Average Daily Landing &Takeoff Cycles .....	35
Table 20 SFO 2035 Internal Regional Airports Average Daily Landing &Takeoff Cycles .....	37
Table 21 SFO 2035 External Regional Airports Average Daily Landing &Takeoff Cycles.....	39
Table 22 SFO 2035 Air Traffic Control Average Daily Landing &Takeoff Cycles .....	41
Table 23 SFO 2035 High Speed Rail Average Daily Landing &Takeoff Cycles.....	43
Table 24 SFO 2035 Demand Management Average Daily Landing &Takeoff Cycles.....	45
Table 25 SJC 2007 Existing Average Daily Landing &Takeoff Cycles.....	47
Table 26 SJC 2035 Baseline Average Daily Landing &Takeoff Cycles .....	49
Table 27 SJC 2035 Redistribution Average Daily Landing &Takeoff Cycles .....	50
Table 28 SJC 2035 Internal Regional Airports Average Daily Landing &Takeoff Cycles.....	51
Table 29 SJC 2035 External Regional Airports Average Daily Landing &Takeoff Cycles.....	52
Table 30 SJC 2035 Air Traffic Control Average Daily Landing &Takeoff Cycles .....	53
Table 31 SJC 2035 High Speed Rail Average Daily Landing &Takeoff Cycles.....	54
Table 32 CCR 2007 Existing Average Daily Landing &Takeoff Cycles.....	55
Table 33 CCR 2035 Baseline Average Daily Landing &Takeoff Cycles.....	56
Table 34 CCR 2035 Internal Regional Airports Average Daily Landing &Takeoff Cycles .....	57
Table 35 STS 2007 Existing Average Daily Landing &Takeoff Cycles .....	58
Table 36 STS 2035 Baseline Average Daily Landing &Takeoff Cycles.....	59
Table 37 STS 2035 Internal Regional Airports Average Daily Landing &Takeoff Cycles .....	60
Table 38 SUU 2007 Existing Average Daily Landing &Takeoff Cycles.....	61
Table 39 SUU 2035 Internal Regional Airports Average Daily Landing &Takeoff Cycles .....	61

## 1 Introduction

Harris Miller Miller and Hanson (HMMH) conducted the airport noise Target Analysis for the Metropolitan Transportation Commission's (MTC) Regional Airport System Planning Analysis (RASPA) update. The objective of the RASPA update is to evaluate a range of solutions to Bay Area airport capacity issues while avoiding constructing new runways in the Bay. The RASPA update used 2007 as the Existing Conditions year and 2035 as the Future year. The Future analysis includes the 2035 Baseline Scenario plus six alternative scenarios which examine various potential airport capacity solutions. The analysis included all three major Bay Area airports, Oakland International Airport (OAK), San Francisco International Airport (SFO), and Norman Y. Mineta San José International Airport (SJC) as well as three regional airports, Buchanan Field Airport (CCR), Charles M. Schulz Sonoma County Airport (STS), and Travis Air Force Base (SUU).

The alternative scenarios that were analyzed for the airport noise Target Analysis are listed below<sup>1</sup>:

### *Airport Redistribution*

This scenario assumes a redistribution of airline service among the three major airports to take advantage of unused runway capacity at less congested airports.

### *Internal Regional Airports:*

This scenario assumes some air passenger demand will be served at Bay Area Alternative Airports, i.e., CCR, STS, and SUU.

### *External Regional Airports:*

This scenario assumes some air passenger demand will be served at Alternative Airports outside the region, i.e., Sacramento International Airport, Monterrey Peninsula Airport, and Stockton Airport.

### *High Speed Rail:*

This scenario assumes construction of a new California High Speed Rail (HSR) system which diverts some air passengers to rail.

### *New Air Traffic Control Technologies:*

This scenario assumes implementation of various new Air Traffic Control (ATC) Technologies to improve runway and airspace capacity in good and bad weather.

### *Demand Management:*

This scenario assumes that SFO adopts Demand Management strategies to better balance aircraft demand with available runway capacity. It assumes some form of differential pricing to promote the use of larger commercial service aircraft during peak hours, bus substitution in close-in markets, and policies that encourage growth in GA demand to shift to GA reliever airports in the Bay Area region.

The noise performance measure for the Target Analysis is the residential population within the 65 decibel (dB) Community Noise Equivalent Level (CNEL) contour. The target of the noise analysis is no increase

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<sup>1</sup> Detailed table of operations for each analysis case are presented in Appendix A

in the regional residential population exposed to 65 dB CNEL or greater in 2035 as compared to 2007. In addition, this report presents the residential population within the 55 dB CNEL contour.

## 2 Noise Modeling Methodology

A set of reference airport operations and the associated CNEL contour grid from a recent Integrated Noise Model (INM) study at each project airport formed the foundation of the noise analysis. Airport staff provided these files to the project team. That foundation was built upon using existing and forecast operations provided by SH&E for the RASPA Update analysis cases. In short, by comparing the operations for an analysis case to the reference operations HMMH determined if the analysis case operations produced more or less noise than the reference operations. HMMH then increased or decreased the size of the reference noise contours based on the operations comparison to produce the noise contours for the analysis case.

For an explanation of the CNEL metric and other airport noise terms see Appendix B.

### 2.1 Comparing Airport Operations Using the Area Equivalent Method

In order to estimate the difference in noise levels between a particular set of reference operations and the airport operations for a particular RASPA Update analysis case, HMMH applied Version 7.0 of the Federal Aviation Administration's (FAA) Area Equivalent Method (AEM)<sup>2</sup>.

AEM is a spreadsheet model which estimates the percentage change in the area of the 65 dB Day-Night Average Sound Level (DNL) contour using only total daytime and nighttime aircraft operations specified by INM aircraft types for a Base and Alternative case. AEM does not take as input flight tracks, stage lengths, runway geometry, or aircraft profiles and thus does not account for changes in these parameters when comparing the different scenarios. HMMH adjusted the AEM operations input to account for the differences in time weighting between the DNL and CNEL metrics using the following formula:

$$\text{AEM Daytime Operations Input} = \text{Daytime Operations} + 3 * \text{Evening Operations}$$

The adjusted operations for the reference case and the particular RASPA Update analysis case were entered into the AEM. The AEM computed the area of the 65 dB CNEL contour for each set of operations<sup>3</sup>. The percentage difference in area was utilized in the next step, scaling the reference noise contours.

### 2.2 Generating Noise Contours with NMPlot

HMMH produced the final noise contours for each RASPA Update analysis case using the latest available version (v4.964) of the noise contouring program NMPlot<sup>4</sup>. NMPlot is the standard noise contouring

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<sup>2</sup> The AEM and the AEM User's Guide are freely available from the FAA here:

[http://www.faa.gov/about/office\\_org/headquarters\\_offices/aep/models/aem\\_model/](http://www.faa.gov/about/office_org/headquarters_offices/aep/models/aem_model/) (Accessed September 2009).

<sup>3</sup> Note that the contour area produced by the AEM is an estimate for a simple one-runway configuration neglecting all standard INM input excepting aircraft operations totals. It is not to be interpreted as an actual contour area for the airport in question. The purpose of the AEM is a comparison of scenarios where the only change is aircraft operations. The percentage change in area, not the area itself is the important output of the AEM.

<sup>4</sup> NMPlot and the NMPlot User's Guide are freely available from Wasmer Consulting here:

<http://wasmerconsulting.com/nmplot.htm> (Accessed October 2009).

program shipped with a variety of government noise modeling including INM. It takes as input a grid of values and draws contours of equal value.

The AEM operations comparison established the estimated percentage difference in contour area between the reference data and the RASPA Update analysis case. HMMH added or subtracted values from the entire reference noise contour grid in NMPlot, to achieve the desired percentage change in the area of the 65 dB CNEL contour. The 65 dB and 55 dB CNEL contours were then exported for the population analysis.

The exception to this method was the analysis of the noise contours at STS. An INM grid file was not available for use in this study. However, an electronic file of the 65 dB CNEL noise contour line was available. Using the same AEM method as outlined above, scale factors for the area of the 65dB CNEL contour were determined for each analysis case. The reference contour was then scaled graphically in a GIS environment to produce the analysis case 65 dB CNEL contour. The 55 dB CNEL contour for each analysis case was produced in a similar manner by scaling the reference 65 dB CNEL contour.

### 3 Population Impact Analysis Methodology

The analysis of population within the 65dB and 55dB CNEL contours was conducted using a Geographic Information System (GIS) program. The Association of Bay Area Governments (ABAG) provided estimated residential population counts by United States Census Tract for 2007<sup>5</sup> and 2035. The values were distributed from the Census Tracts enumeration units to Census Block enumeration units (see Figure 1 for a comparison of Census Tracts and Blocks). The percent of total population for each Census Block was calculated comparing the population values for the year 2000 to the total tract population for the same year. This percent value was then used to assign projected growth population to each Census Block for the required years<sup>6</sup>.

Using GIS tools, the contours were intersected with the Census Block data for each CNEL noise contour interval. The resultant wholly or partially encompassed Census Block areas were then calculated to determine the percent of original Census Block that was impacted. This percentage value was then used to determine the estimated residential population and housing unit counts impacted in the following manner:

$$\text{Block Population within Noise Contour} = \text{Percentage of Block Area within Noise Contour} * \text{Total Block Population}$$

The total population within the contour was summed from the results for each Census block. In this way HMMH computed the total residential population within the 65 dB and 55dB CNEL contours for each study analysis case.

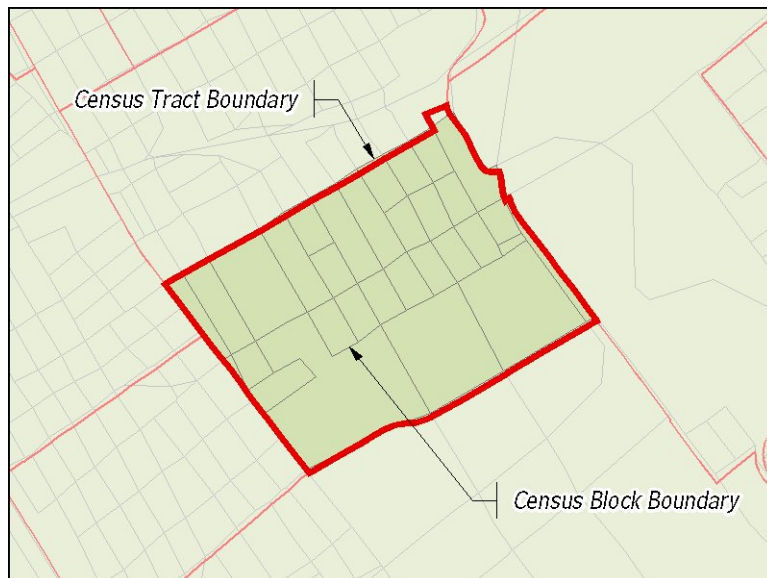


Figure 1 United States Census Tract and Blocks

<sup>5</sup> Values for 2007 were linearly interpolated between the 2005 and 2010 estimates.

<sup>6</sup> The 55 dB contours for SUU extended slightly beyond the borders of the ABAG population forecast. The contours intersected a single census block with non-zero residential population in the 2000 Census. The Census 2000 population for this block was utilized for all analysis cases.

It should be noted that these estimates of residences within the noise contours may differ from counts in other noise studies. Other detailed studies may use parcel-level data, land use maps, or field verification to distinguish residential portions of the Census Block from non-residential areas. This survey-level analysis relies on the assumption of an even population distribution across each Census Block. Additionally, the counts presented in this study do not distinguish between residences which are deemed as compatible due to a mitigation measure such as sound insulation and those that have not been mitigated or otherwise deemed compatible.

## 4 Noise Modeling Results

The presentation of population within the 65 dB and 55 dB CNEL contours is divided into three parts. The first section presents the results for each analysis scenario. The second section parses the results to separate the effects of changes in noise level and population growth. The third section attributes the differences in noise exposure between the scenarios to the trends in aircraft operations.

### 4.1 Results

Table 1 presents the population within the 65 dB CNEL contour for each analysis scenario. The 2007 Existing scenario results reflect noise levels in 2007 and estimated 2007 population. The increases in exposed population for the 2035 analysis scenarios reflect both the changes in noise levels due to aircraft operations and the expected growth in population between 2007 and 2035.

The High Speed Rail scenario results in the lowest population within the 65 dB CNEL contours in 2035 for both OAK and SJC and all airports combined. The lowest population count for SFO occurs for the Airport Redistribution scenario.

The Airport Redistribution scenario results in the highest population within the 65 dB CNEL contours in 2035 for both OAK and SJC. The highest population count for SFO and the three airports combined occurs for the Baseline scenario.

**Table 1 Residential Population within the 65 dB CNEL Contour by Airport and Analysis Scenario**

Airport	2007 Existing	2035 Baseline	2035 Airport Redistribution	2035 Internal Regional Airports	2035 External Regional Airports	2035 High Speed Rail	2035 New Air Traffic Control Technologies	2035 Demand Management
OAK	486	657	731	617	644	593	656	657
SFO	20,196	48,614	46,287	47,934	48,323	47,073	47,644	48,033
SJC	1,749	5,644	7,385	5,601	4,927	3,571	5,644	5,644
CCR	20	33	33	76	33	33	33	33
STS	143	224	224	236	224	224	224	224
SUU	786	1,008	1,008	1,010	1,008	1,008	1,008	1,008
<b>Total</b>	<b>23,380</b>	<b>56,180</b>	<b>55,668</b>	<b>55,474</b>	<b>55,159</b>	<b>52,502</b>	<b>55,209</b>	<b>55,599</b>

Table 2 presents the population within the 55 dB CNEL contour for each analysis scenario. The 2007 Existing scenario results reflect noise levels in 2007 and estimated 2007 population. The increases in exposed population for the 2035 analysis scenarios reflect both the changes in noise levels due to aircraft operations and the growth of population between 2007 and 2035.

The High Speed Rail scenario results in the lowest population within the 65 dB CNEL contours in 2035 for OAK and SJC as well as all airports combined. The lowest population count for SFO occurs for the Airport Redistribution scenario.

The Airport Redistribution scenario results in the highest population within the 55 dB CNEL contours in 2035 for OAK and SJC as well as all airports combined. The highest population count for SFO occurs for the Baseline scenario.

**Table 2 Residential Population within the 55 dB CNEL Contour by Airport and Analysis Scenario**

Airport	2007 Existing	2035 Baseline	2035 Airport Redistribution	2035 Internal Regional Airports*	2035 External Regional Airports	2035 High Speed Rail	2035 New Air Traffic Control Technologies	2035 Demand Management
OAK	35,003	48,139	52,541	45,708	47,302	44,464	48,014	48,139
SFO	127,289	193,235	187,614	191,513	192,467	189,427	190,804	191,744
SJC	53,947	145,195	152,530	144,990	141,074	130,899	145,195	145,195
CCR	2,811	3,906	3,906	6,493	3,906	3,906	3,906	3,906
STS	694	1,049	1,049	1,100	1,049	1,049	1,049	1,049
SUU	8,852	10,714	10,714	10,726	10,714	10,714	10,714	10,714
<b>Total</b>	<b>228,596</b>	<b>402,238</b>	<b>408,354</b>	<b>400,530</b>	<b>396,512</b>	<b>380,459</b>	<b>399,682</b>	<b>400,747</b>

## 4.2 Effects of Changes in Noise and Population Growth

The effect of changes in noise can be isolated from changes in population by computing the exposed population for each scenario without changing the population data. Table 3 and Table 4 present the 2007 population within the 65 dB and 55 dB CNEL contours for each analysis scenario.

The scenarios with the greatest and least exposed population for each individual airport and the three airports combined remain unchanged from those in the previous section.

**Table 3 2007 Residential Population within the 65 dB CNEL Contour by Airport and Analysis Scenario**

Airport	2007 Existing	2035 Baseline	2035 Airport Redistribution	2035 Internal Regional Airports*	2035 External Regional Airports	2035 High Speed Rail	2035 New Air Traffic Control Technologies	2035 Demand Management
OAK	486	617	686	578	605	557	615	617
SFO	20,196	40,385	38,408	39,807	40,132	39,077	39,567	39,887
SJC	1,749	3,019	3,880	3,001	2,668	2,003	3,019	3,019
CCR	20	28	28	62	28	28	28	28
STS	143	214	214	225	214	214	214	214
SUU	786	786	786	788	786	786	786	786
<b>Total</b>	<b>23,380</b>	<b>45,049</b>	<b>44,002</b>	<b>44,461</b>	<b>44,433</b>	<b>42,665</b>	<b>44,229</b>	<b>44,551</b>

**Table 4 2007 Residential Population within the 55 dB CNEL Contour by Airport and Analysis Scenario**

Airport	2007 Existing	2035 Baseline	2035 Airport Redistribution	2035 Internal Regional Airports*	2035 External Regional Airports	2035 High Speed Rail	2035 New Air Traffic Control Technologies	2035 Demand Management
OAK	35,003	41,823	45,555	39,729	41,109	38,636	41,723	41,823
SFO	127,289	160,329	155,672	158,923	159,718	157,188	158,351	159,120
SJC	53,947	61,422	65,003	61,328	59,648	55,579	61,422	61,422
CCR	2,811	3,393	3,393	5,679	3,393	3,393	3,393	3,393
STS	694	931	931	970	931	931	931	931
SUU	8,852	8,852	8,852	8,862	8,852	8,852	8,852	8,852
<b>Total</b>	<b>228,596</b>	<b>276,750</b>	<b>279,406</b>	<b>275,491</b>	<b>273,651</b>	<b>264,579</b>	<b>274,672</b>	<b>275,541</b>

Table 5 and Table 6 parse the differences between the 2007 Existing and 2035 Baseline Scenarios results in the four tables above to show the relative importance of differences in noise and population to the total difference in population within the 65 dB and 55 dB CNEL contours.

**Table 5 Comparison of Noise Effects and Population Growth Effects for the 2035 Baseline Scenario – 65 dB CNEL**

Airport	2007 Population within 2007 Existing Contour	2007 Population Between 2007 Existing Contour and 2035 Baseline Contour	Population Growth within 2035 Baseline Contour	Total 2035 Population within 2035 Baseline Contour	Percentage of Change Due to Noise	Percentage of Change Due to Population Growth
OAK	486	131	40	657	77%	23%
SFO	20,196	20,189	8,229	48,614	71%	29%
SJC	1,749	1,270	2,625	5,644	33%	67%
CCR	20	8	5	33	62%	38%
STS	143	71	10	224	88%	12%
SUU	786	0	222	1,008	0%	100%
<b>Total</b>	<b>23,380</b>	<b>21,669</b>	<b>11,131</b>	<b>56,180</b>	<b>66%</b>	<b>34%</b>

**Table 6 Comparison of Noise Effects and Population Growth Effects for the 2035 Baseline Scenario – 55 dB CNEL**

Airport	2007 Population within 2007 Existing Contour	2007 Population Between 2007 Existing Contour and 2035 Baseline Contour	Population Growth within 2035 Baseline Contour	Total 2035 Population within 2035 Baseline Contour	Percentage of Change Due to Noise	Percentage of Change Due to Population Growth
OAK	35,003	6,820	6,316	48,139	52%	48%
SFO	127,289	33,040	32,906	193,235	50%	50%
SJC	53,947	7,475	83,773	145,195	8%	92%
CCR	2,811	582	513	3,906	53%	47%
STS	694	237	118	1,049	67%	33%
SUU	8,852	0	1,862	10,714	0%	100%
<b>Total</b>	<b>228,596</b>	<b>48,154</b>	<b>125,488</b>	<b>402,238</b>	<b>28%</b>	<b>72%</b>

### 4.3 Noise Contributors

The analysis of noise contributors is divided into two sections. The first examines the differences in noise levels between the 2007 Existing and 2035 Baseline scenarios. The second section examines the differences in noise between the 2035 Baseline and the various 2035 alternative scenarios.

#### 4.3.1 2035 Baseline Compared to 2007 Existing

Table 7 displays the percentage allocation of aircraft operations by time of day, the total number of actual and effective operations, the ratio of effective operations to actual operations and the change in noise level between the 2007 Existing and 2035 Baseline scenarios. The table shows that actual operations increase at all airports between 2007 and 2035. The number of effective operations is computed by adding the daytime operations to three times the evening operations and ten times the night operations. These multipliers are the same as the CNEL metric uses. On a percentage basis the effective operations increase more than the actual operations. The slight shift of operations for each airport toward the evening and nighttime can be seen in the column which displays the ratio of effective operations to actual operations. A higher number indicates a greater proportion of operations in the evening and nighttime.

The final column in the table lists the increase in CNEL between the 2007 Existing and the 2035 Baseline scenarios. As can be seen, the greatest increases in both effective operations and noise occur for SFO.

**Table 7 Distribution of 2007 Existing and 2035 Baseline Operations**

Airport	Scenario	Percentage Daytime Operations	Percentage Evening Operations	Percentage Nighttime Operations	Average Daily Landing and Takeoff Cycles	Average Daily Effective Operations	Effective Operations per Actual Operation	Approximate Change in CNEL Relative to 2007 Existing
OAK	2007 Existing	71.1%	13.5%	15.4%	462	1226	2.65	-
	2035 Baseline	69.5%	14.6%	15.9%	486	1324	2.72	0.8
SFO	2007 Existing	74.6%	11.8%	13.6%	511	1257	2.46	-
	2035 Baseline	73.8%	12.0%	14.2%	721	1817	2.52	2.2
SJC	2007 Existing	76.9%	16.2%	6.9%	274	533	1.95	-
	2035 Baseline	76.7%	16.2%	7.1%	333	653	1.96	0.8
CCR	2007 Existing	93.6%	4.7%	1.7%	172	215	1.25	-
	2035 Baseline	93.6%	4.7%	1.7%	183	229	1.25	0.5
STS	2007 Existing	89.7%	7.6%	2.7%	177	246	1.39	-
	2035 Baseline	90.0%	7.5%	2.5%	268	369	1.37	2.9
SUU	2007 Existing	76.6%	14.8%	8.6%	85	176	2.07	-
	2035 Baseline	76.6%	14.8%	8.6%	85	176	2.07	0.0

The AEM does not have the functionality to compute the contribution of individual aircraft to the changes in noise level. However, the INM has this capability and is the basis for the calculations in the AEM. It would be reasonable to use noise values computed from the INM to determine the most important aircraft to the changes observed in the AEM. A table of INM-computed Sound Exposure Level (SEL) values for arrivals and departures at a location close-in to a test airport was utilized to examine the noise contributors. For details on changes in operations between the noise analysis scenarios, reference the detailed operations tables in Appendix A

For OAK, the dominant factor to the increase in noise levels was an increase in airline passenger B-737s. The next largest factor was the introduction of B-777s. These increases in noise were partially offset by the elimination of operations by B-727s and the reduction in DC10/MD11 operations.

At SFO, an increase in B-747 operations was the greatest contributing factor to increases in noise levels with an increase in B-737 operations also playing a significant role. These increases were offset slightly by a small reduction in noise due to the elimination of B-757 operations.

At SJC increases in operations by A-318/319/320/321s, B-737s, and LJ35s were the top contributors to the increase in noise. The largest decrease in noise levels occurred due to the elimination of MD80s.

Growth in propeller aircraft operations at CCR was the primary cause of the increase in noise between 2007 and 2035.

The introduction of Very Light Jet (VLJ), regional jet, and B-737 operations plus the increase in other jet operations at STS were the primary causes of the increase in noise between 2007 and 2035.

At SUU the operations remained unchanged between 2007 and 2035.

#### 4.3.2 2035 Alternative Scenarios Compared to 2035 Baseline

Table 8 displays the percentage allocation of aircraft operations by time of day, the total number of actual and effective operations, the ratio of effective operations to actual operations and the change in noise level between each 2035 analysis scenario and the 2035 Baseline scenarios.

As shown, the distribution of flights by time of day changes between the Baseline and each of the scenarios. For example, the percentage of SFO's flights in the noise sensitive evening and nighttime hours declines compared to the Baseline. The principal reason for changes in the time-of-day distribution of flight is the reduction in average aircraft delays which results in fewer flights being shifted from daytime to evening or from evening to nighttime hours. Changes to airline flight schedules in the demand management scenario, in which flights are reduced during the morning and early afternoon peak at SFO, also alters the time-of-day distribution of aircraft flights at SFO.

Table 8 Distribution of 2035 Baseline and Alternative Scenarios Operations

Airport	Scenario	Percentage Daytime Operations	Percentage Evening Operations	Percentage Nighttime Operations	Average Daily Landing and Takeoff Cycles	Average Daily Effective Operations	Effective Operations per Actual Operation	Approx. Change in CNEL Relative to 2035 Baseline
OAK	2035 Baseline	69.5%	14.6%	15.9%	486	1324	2.72	-
	2035 Airport Redistribution	69.3%	14.8%	15.9%	517	1408	2.72	0.4
	2035 Internal Regional Airports	69.6%	14.4%	15.9%	469	1276	2.72	-0.2
	2035 External Regional Airports	69.6%	14.5%	15.9%	480	1306	2.72	-0.1
	2035 High Speed Rail	69.7%	14.4%	15.9%	461	1255	2.72	-0.3
	2035 New Air Traffic Control Technologies	69.6%	14.5%	15.8%	486	1320	2.71	0.0
	2035 Demand Management	Same as 2035 Baseline						

Table 8 Distribution of 2035 Baseline and Alternative Scenarios Operations

Airport	Scenario	Percentage Daytime Operations	Percentage Evening Operations	Percentage Nighttime Operations	Average Daily Landing and Takeoff Cycles	Average Daily Effective Operations	Effective Operations per Actual Operation	Approx. Change in CNEL Relative to 2035 Baseline	
SFO	2035 Baseline	73.8%	12.0%	14.2%	721	1817	2.52	-	
	2035 Airport Redistribution	74.3%	11.9%	13.8%	670	1661	2.48	-0.2	
	2035 Internal Regional Airports	73.9%	11.9%	14.1%	707	1773	2.51	-0.1	
	2035 External Regional Airports	73.9%	11.9%	14.2%	716	1800	2.51	0.0	
	2035 High Speed Rail	74.2%	11.9%	13.9%	683	1702	2.49	-0.2	
	2035 New Air Traffic Control Technologies	74.6%	11.9%	13.5%	721	1770	2.45	-0.1	
	2035 Demand Management	74.0%	12.0%	14.0%	692	1732	2.50	-0.1	
SJC	2035 Baseline	76.7%	16.2%	7.1%	333	653	1.96	-	
	2035 Airport Redistribution	76.4%	16.5%	7.1%	357	704	1.97	0.4	
	2035 Internal Regional Airports	76.7%	16.2%	7.1%	332	652	1.96	0.0	
	2035 External Regional Airports	76.8%	16.1%	7.1%	322	632	1.96	-0.2	
	2035 High Speed Rail	77.1%	15.8%	7.1%	302	591	1.96	-0.6	
	2035 New Air Traffic Control Technologies	76.7%	16.2%	7.1%	333	653	1.96	0.0	
	2035 Demand Management	Same as 2035 Baseline							
CCR	2035 Baseline	93.6%	4.7%	1.7%	183	229	1.25	-	
	2035 Airport Redistribution	Same as 2035 Baseline							
	2035 Internal Regional Airports	93.6%	4.7%	1.7%	213	265	1.25	1.4	
	2035 External Regional Airports	Same as 2035 Baseline							
	2035 High Speed Rail	Same as 2035 Baseline							
	2035 New Air Traffic Control Technologies	Same as 2035 Baseline							
	2035 Demand Management	Same as 2035 Baseline							
STS	2035 Baseline	90.0%	7.5%	2.5%	268	369	1.37	-	
	2035 Airport Redistribution	Same as 2035 Baseline							
	2035 Internal Regional Airports	90.0%	7.5%	2.5%	282	388	1.37	0.4	
	2035 External Regional Airports	Same as 2035 Baseline							
	2035 High Speed Rail	Same as 2035 Baseline							
	2035 New Air Traffic Control Technologies	Same as 2035 Baseline							
	2035 Demand Management	Same as 2035 Baseline							
SUU	2035 Baseline	76.6%	14.8%	8.6%	85	176	2.07	-	

**Table 8 Distribution of 2035 Baseline and Alternative Scenarios Operations**

Airport	Scenario	Percentage Daytime Operations	Percentage Evening Operations	Percentage Nighttime Operations	Average Daily Landing and Takeoff Cycles	Average Daily Effective Operations	Effective Operations per Actual Operation	Approx. Change in CNEL Relative to 2035 Baseline
	2035 Airport Redistribution	Same as 2035 Baseline						
	2035 Internal Regional Airports	80.0%	13.0%	7.0%	114	216	1.89	0.0
	2035 External Regional Airports	Same as 2035 Baseline						
	2035 High Speed Rail	Same as 2035 Baseline						
	2035 New Air Traffic Control Technologies	Same as 2035 Baseline						
	2035 Demand Management	Same as 2035 Baseline						

Examination of the table above and the INM SELs noise contributors analysis leads to the following observations:

- OAK 2035 Airport Redistribution – increase in noise due primarily to increase in B-737 operations
- OAK 2035 Internal Regional Airports – decrease in noise due primarily to decrease in B-737 operations
- OAK 2035 External Regional Airports - decrease in noise due primarily to decrease in B-737 operations
- OAK 2035 High Speed Rail - decrease in noise due primarily to decrease in B-737 operations
- OAK 2035 New Air Traffic Control Technologies – very slight decrease in noise due primarily to slight shift in operations toward evening and daytime periods
- SFO 2035 Airport Redistribution – decrease in noise due primarily to decrease in B-737 and A-318/319/320/321 operations
- SFO 2035 Internal Regional Airports – decrease in noise due primarily to decrease in B-737 and A-318/319/320/321 operations
- SFO 2035 External Regional Airports – decrease in noise due primarily to decrease in B-737 and A-318/319/320/321 operations
- SFO 2035 High Speed Rail – decrease in noise due primarily to decrease in B-737 and A-318/319/320/321 operations
- SFO 2035 New Air Traffic Control Technologies – decrease in noise due primarily to shift in operations toward evening and daytime periods especially for B-737, B-747, and A-318/319/320/321 operations

- SFO 2035 Demand Management –slight decrease in noise due shifts and decreases in operations by regional jets, turboprops, and general aviation aircraft
- SJC 2035 Airport Redistribution – increase in noise due primarily to increase in B-737 and A-318/319/320/321 operations
- SJC 2035 Internal Regional Airports – essentially no change in noise due to very slight decreases in B-737, A-318/319/320/321, and RJ-700 aircraft
- SJC 2035 External Regional Airports - decrease in noise due primarily to decrease in B-737 and A-318/319/320/321 operations
- SJC 2035 High Speed Rail - decrease in noise due primarily to decrease in B-737 and A-318/319/320/321 operations
- SJC 2035 New Air Traffic Control Technologies – essentially no change in noise due to shifts in operations
- CCR Internal Regional Airports – increase in noise due to addition of service by CRJ-700.
- STS Internal Regional Airports – increase in noise due to increase operations by CRJ-700.
- SUU Internal Regional Airports –addition CRJ-700 operations has negligible effect due to high noise levels from military aircraft.

## **Appendix A      Aircraft Operations Tables**

The AEM requires average daily operations by aircraft type in terms of landing and takeoff cycles (LTOs) in order to estimate the area of a specified noise contour. SH&E produced the required tables of operations for each analysis scenario in the RASPA Update.

In order to enter these operations into the AEM, HMMH matched each aircraft in the SH&E tables to a specific type within the AEM. In many cases a simple one-to-one match was possible. When multiple types matched (e.g. a Boeing 737-300 can be a 737300 or 7373B3 in the AEM depending on the particular engines), HMMH distributed the operations among the AEM types using percentages developed from a database of all commercial aircraft operating in the United States. The AEM has a limited number of military aircraft types and no helicopters. Single engine helicopters were modeled as a single engine propeller aircraft and twin engine helicopters were modeled as a twin engine propeller aircraft. For cases where a fixed-wing type was not available in the AEM, the noise values for the desired aircraft were compared to the available AEM aircraft using the INM. The closest match was used as the proxy in the AEM.

Table 9 displays the AEM type(s) used for each aircraft in the SH&E operations tables. For traceability the aircraft types are exactly as received from SH&E. The remaining tables in this appendix display the operations used for each analysis case.

Table 9 AEM Aircraft Type Assignments

Aircraft	AEM Type	Fraction (0.01 = 1%)
747	747200	0.05
747	747400	0.38
747	74710Q	0.09
747	74720A	0.09
747	74720B	0.34
747	747SP	0.03
757	757300	0.06
757	757PW	0.51
757	757RR	0.43
767	767300	0.66
767	767400	0.10
767	767CF6	0.21
767	767JT9	0.03
777	777200	1.00
727 (all)	727D17	0.01
727 (all)	727EM1	0.09
727 (all)	727EM2	0.73
727 (all)	727Q15	0.01
727 (all)	727Q7	0.02
727 (all)	727Q9	0.04
727 (all)	727QF	0.11
737-200/300	737300	0.61
737-200/300	7373B2	0.24
737-200/300	737N17	0.09
737-200/300	737N9	0.06
737-3/4/500	737300	0.46
737-3/4/500	737400	0.16
737-3/4/500	737500	0.20
737-3/4/500	7373B2	0.18
737-3/500	737300	0.55
737-3/500	737500	0.24
737-3/500	7373B2	0.22
737-300	737300	0.72
737-300	7373B2	0.28
737-400/500	737400	0.44
737-400/500	737500	0.56
737-7/8/900	737700	0.55
737-7/8/900	737800	0.45
737-7/900	737700	0.93
737-7/900	737800	0.07
737-700/800/900	737700	0.55
737-700/800/900	737800	0.45
747 (all)	747200	0.05
747 (all)	747400	0.38
747 (all)	74710Q	0.09
747 (all)	74720A	0.09
747 (all)	74720B	0.34

Table 9 AEM Aircraft Type Assignments

Aircraft	AEM Type	Fraction (0.01 = 1%)
747 (all)	747SP	0.03
757 (all)	757300	0.06
757 (all)	757PW	0.51
757 (all)	757RR	0.43
767 (all)	767300	0.66
767 (all)	767400	0.10
767 (all)	767CF6	0.21
767 (all)	767JT9	0.03
777 (all)	777200	1.00
787-9 / A-350	A330-343	1.00
A109	BEC58P	1.00
A109 - Helicopter	BEC58P	1.00
A300	A300-622R	0.87
A300	A300B4-203	0.13
A-318/319/320/321	A319-131	0.43
A-318/319/320/321	A320-211	0.16
A-318/319/320/321	A320-232	0.36
A-318/319/320/321	A321-232	0.05
A330	A330-301	1.00
A-330/340	A330-301	0.50
A-330/340	A340-211	0.50
A-380	747400	1.00
AC90	CNA441	1.00
ASTR	IA1125	1.00
AT43	DHC8	1.00
AT43/AT72/BA41	DHC8	0.32
AT43/AT72/BA41	HS748A	0.59
AT43/AT72/BA41	SF340	0.09
AT72	HS748A	1.00
B190/BE99/PA32	1900D	0.57
B190/BE99/PA32	DHC6	0.25
B190/BE99/PA32	GASEPV	0.18
B206L	GASEPV	1.00
B350	DHC6	1.00
BE20	DHC6	1.00
BE30	DHC6	1.00
BE35	GASEPV	1.00
BE36	GASEPV	1.00
BE40	MU3001	1.00
BE55	BEC58P	1.00
BE58	BEC58P	1.00
BE60	BEC58P	1.00
BE76	BEC58P	1.00
BE95	BEC58P	1.00
BE99	DHC6	1.00
BE9L	CNA441	1.00
BEC190	1900D	1.00

Table 9 AEM Aircraft Type Assignments

Aircraft	AEM Type	Fraction (0.01 = 1%)
BEC58P	BEC58P	1.00
BEC9F	CNA441	1.00
Beech 400	MU3001	1.00
Boeing 737-700	737700	1.00
C130	C130	1.00
C-141A	707320	1.00
C150	CNA172	1.00
C152	CNA172	1.00
C172	CNA172	1.00
C182	CNA206	1.00
C206	CNA206	0.82
C206	CNA20T	0.18
C208	GASEPF	1.00
C210	CNA206	0.59
C210	CNA20T	0.41
C25A	CNA500	1.00
C25B	CNA500	1.00
C310	BEC58P	1.00
C340	BEC58P	1.00
C402	BEC58P	1.00
C414	BEC58P	1.00
C421	BEC58P	1.00
C425	CNA441	1.00
C441	CNA441	1.00
C501	CNA500	1.00
C525	CNA500	1.00
C550	CNA55B	0.14
C550	MU3001	0.86
C560	MU3001	1.00
C56X	CNA55B	1.00
C-5A	74720B	1.00
C650	CIT3	1.00
C680	LEAR35	1.00
C750	CNA750	1.00
Cessna 550	MU3001	1.00
Cessna 650	CIT3	1.00
Cessna 750	CNA750	1.00
Challenger 600	CL600	1.00
CIT3	CIT3	1.00
CL30	CL600	1.00
CL60	CL600	0.03
CL60	CL601	0.97
CL600	CL600	1.00
CNA172	CNA172	1.00
CNA206	CNA206	1.00
CNA20T	CNA20T	1.00
CNA441	CNA441	1.00

Table 9 AEM Aircraft Type Assignments

Aircraft	AEM Type	Fraction (0.01 = 1%)
CNA500	CNA500	1.00
CNA55B	CNA55B	1.00
CNA750	CNA750	1.00
CRJ-700	GV	1.00
CRJ-700-RJ	GV	1.00
CRJ-900-RJ	GV	1.00
D328	DHC8	1.00
DC10/MD11	DC1010	0.28
DC10/MD11	DC1030	0.25
DC10/MD11	MD11GE	0.21
DC10/MD11	MD11PW	0.25
DC8	DC870	0.71
DC8	FAL20	0.29
DC9	DC93LW	0.72
DC9	DC95HW	0.28
DH8D	DHC830	1.00
DHC6	DHC6	1.00
DHC8	DHC8	1.00
DHC-8-100	DHC8	1.00
DHC830	DHC830	1.00
DHC-8-400	DHC830	1.00
EMB-120	EMB120	1.00
EMB-140	EMB145	1.00
EMB-145/ERJ-145	EMB145	0.08
EMB-145/ERJ-145	EMB14L	0.92
EMB-170	GV	1.00
EMB-170-RJ	GV	1.00
EMB-190	EMB14L	1.00
EMB-190-RJ	GV	1.00
F16	F16A	1.00
F18	A7D	1.00
F2TH	CL600	1.00
F900	LEAR35	1.00
FA20	FAL20	0.92
FA20	LEAR35	0.08
FA50	LEAR35	1.00
FAL20	FAL20	1.00
Falcon 50	LEAR35	1.00
Falcon 900	LEAR35	1.00
G159	HS748A	1.00
GALX	CL601	1.00
GASEPF	GASEPF	1.00
GASEPV	GASEPV	1.00
GIIB	GIIB	1.00
GIV	GIV	1.00
GL5T	GV	1.00
GLEX	GV	1.00

Table 9 AEM Aircraft Type Assignments

Aircraft	AEM Type	Fraction (0.01 = 1%)
GLF2	GII	0.90
GLF2	GIIB	0.10
GLF3	GIIB	1.00
GLF4	GIV	1.00
GLF5	GV	1.00
Gulfstream III	GIIB	1.00
Gulfstream IV	GIV	1.00
Gulfstream V	GV	1.00
H25A	LEAR25	0.20
H25A	LEAR35	0.80
H25B	LEAR35	1.00
Hawker H25	LEAR35	1.00
HS748A	HS748A	1.00
IA1125	IA1125	1.00
KC-10A	DC950	1.00
KC-135R	KC135	1.00
Lear 45	LEAR35	1.00
Lear 60	LEAR35	1.00
LEAR25	LEAR25	1.00
LEAR35	LEAR35	1.00
Lear60	LEAR35	1.00
LJ31	LEAR35	1.00
LJ35	LEAR35	1.00
LJ35/LR35	LEAR35	1.00
LJ45	LEAR35	1.00
LJ55	LEAR35	1.00
LJ60	LEAR35	1.00
M20P	GASEPV	1.00
MD-80 (all)	MD81	0.02
MD-80 (all)	MD82	0.49
MD-80 (all)	MD83	0.49
MU3001	MU3001	1.00
P180	SD330	1.00
P28A	GASEPF	1.00
P32R/NAV	GASEPV	1.00
P46T	SD330	1.00
PA18	GASEPF	1.00
PA31	CNA441	0.00
PA31	PA31	1.00
PA31/SW3	CNA441	0.03
PA31/SW3	PA31	0.97
PA32	GASEPV	1.00
PA34	BEC58P	1.00
PAY2	CNA441	1.00
PC12	1900D	1.00
Piaggio Twin-engine prop	DHC6	1.00
Piaggio-Twin-engine prop	DHC6	1.00

Table 9 AEM Aircraft Type Assignments

Aircraft	AEM Type	Fraction (0.01 = 1%)
PRM1	CNA500	1.00
Q-400–Twin-engine prop	DHC830	1.00
RJ-200/ER	CL601	1.00
RJ-700	GV	1.00
RJ-900	GV	1.00
SABR80	SABR80	1.00
SBR1	LEAR25	0.73
SBR1	LEAR35	0.27
SF-340	SF340	1.00
Single-engine,Fixed	GASEPF	1.00
Single-engine,Variable	GASEPV	1.00
SR22	GASEPV	1.00
SW3	CNA441	1.00
SW4	DHC6	1.00
T33	LEAR35	1.00
T-38A	LEAR25	1.00
TBM7	1900D	1.00
Twin-engine,Piston	BEC58P	1.00
Twin-engine,Turboprop	CNA441	1.00
Very Light jets (VLJ)	CNA55B	1.00
WW24	IA1125	1.00

Table 10 OAK 2007 Existing Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-300	45.5	11.4	8.5
Airline-Psgr	737-400/500	6.2	1.5	1.1
Airline-Psgr	737-700/800/900	62.7	15.7	11.7
Airline-Psgr	757 (all)	1.7	0.4	0.3
Airline-Psgr	A-318/319/320/321	15.9	4.0	3.0
Airline-Psgr	EMB-145/ERJ-145	1.5	0.4	0.3
Airline-Psgr	MD-80 (all)	5.4	1.4	1.0
Airline-Psgr	RJ-200/ER	6.1	1.5	1.1
Airline-Psgr	RJ-700	2.0	0.5	0.4
Airline-Psgr	RJ-900	1.5	0.4	0.3
Airline-AC	747 (all)	0.1	0.0	0.1
Airline-AC	DC10/MD11	5.0	2.2	5.2
Airline-AC	A300	2.9	1.3	3.0
Airline-AC	767 (all)	1.5	0.7	1.6
Airline-AC	757 (all)	0.5	0.2	0.5
Airline-AC	DC8	0.0	0.0	0.0
Airline-AC	DC9	0.0	0.0	0.0
Airline-AC	727 (all)	1.5	0.7	1.6
Airline-AC	737-200/300	0.0	0.0	0.0
Airline-AC	LJ35/LR35	0.0	0.0	0.0
Airline-AC	AT43/AT72/BA41	0.5	0.2	0.5
Airline-AC	B190/BE99/PA32	1.4	0.6	1.4
Airline-AC	SW4	1.4	0.6	1.4
Airline-AC	PA31/SW3	2.9	1.3	3.0
Airline-AC	P32R/NAV	0.0	0.0	0.0
Airline-AC	UNK	0.0	0.0	0.0
GA-BJ	ASTR	0.2	0.0	0.0
GA-BJ	BE40	1.3	0.2	0.1
GA-BJ	C25A	0.2	0.0	0.0
GA-BJ	C25B	0.2	0.0	0.0
GA-BJ	C501	0.2	0.0	0.0
GA-BJ	C525	0.6	0.1	0.1
GA-BJ	C550	1.1	0.1	0.1
GA-BJ	C560	1.7	0.2	0.2
GA-BJ	C56X	1.1	0.1	0.1
GA-BJ	C650	0.3	0.0	0.0
GA-BJ	C680	0.3	0.0	0.0
GA-BJ	C750	1.0	0.1	0.1
GA-BJ	CL30	0.5	0.1	0.1
GA-BJ	CL60	1.5	0.2	0.2
GA-BJ	F2TH	0.6	0.1	0.1
GA-BJ	F900	0.9	0.1	0.1
GA-BJ	FA20	0.3	0.0	0.0
GA-BJ	FA50	0.6	0.1	0.1
GA-BJ	GALX	0.3	0.0	0.0
GA-BJ	GLEX	0.3	0.0	0.0
GA-BJ	GLF2	0.2	0.0	0.0

Table 10 OAK 2007 Existing Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
GA-BJ	GLF3	0.7	0.1	0.1
GA-BJ	GLF4	1.6	0.2	0.2
GA-BJ	GLF5	0.4	0.1	0.0
GA-BJ	H25B	1.8	0.2	0.2
GA-BJ	LJ31	0.2	0.0	0.0
GA-BJ	LJ35	1.0	0.1	0.1
GA-BJ	LJ45	0.7	0.1	0.1
GA-BJ	LJ60	0.5	0.1	0.0
GA-BJ	PRM1	0.3	0.0	0.0
GA-BJ	VV24	0.3	0.0	0.0
GA-MEL	BE55	0.3	0.0	0.0
GA-MEL	BE58	0.3	0.0	0.0
GA-MEL	BE76	0.3	0.0	0.0
GA-MEL	C206	1.0	0.1	0.2
GA-MEL	C310	0.3	0.0	0.0
GA-MEL	C340	0.5	0.0	0.1
GA-MEL	C414	0.4	0.0	0.1
GA-MEL	C421	0.4	0.0	0.1
GA-MEL	PA31	7.4	0.8	1.2
GA-SEL	BE35	1.3	0.1	0.2
GA-SEL	BE36	1.2	0.1	0.2
GA-SEL	C152	0.6	0.1	0.1
GA-SEL	C172	9.4	1.0	1.5
GA-SEL	C182	1.6	0.2	0.3
GA-SEL	C210	1.1	0.1	0.2
GA-SEL	M20P	1.6	0.2	0.3
GA-SEL	P28A	5.1	0.5	0.8
GA-SEL	SR22	1.3	0.1	0.2
GA-TP	AT43	0.6	0.1	0.1
GA-TP	AT72	0.5	0.0	0.1
GA-TP	B350	0.5	0.1	0.1
GA-TP	BE20	1.1	0.1	0.2
GA-TP	BE30	0.4	0.0	0.1
GA-TP	BE99	3.2	0.3	0.5
GA-TP	BE9L	0.5	0.1	0.1
GA-TP	C208	5.5	0.6	0.9
GA-TP	D328	0.8	0.1	0.1
GA-TP	DH8D	0.3	0.0	0.1
GA-TP	P180	0.9	0.1	0.1
GA-TP	PC12	1.5	0.2	0.2
GA-TP	SW3	0.4	0.0	0.1
GA-TP	SW4	2.8	0.3	0.4
Military	C130	0.2	0.0	0.0
Military	F18	0.2	0.0	0.0
Military	F16	0.1	0.0	0.0
Local	C152	32.5	3.4	5.2
Local	C172	26.4	2.8	4.2

**Table 10 OAK 2007 Existing Average Daily Landing & Takeoff Cycles**

<b>Category</b>	<b>Aircraft</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
Local	PA18	29.1	3.1	4.7
<b>Total</b>		<b>328.5</b>	<b>62.6</b>	<b>71.0</b>

Table 11 OAK 2035 Baseline Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-700/800/900	162.1	40.7	30.9
Airline-Psgr	787-9 / A-350	2.7	0.7	0.5
Airline-Psgr	A-318/319/320/321	27.8	7.0	5.3
Airline-Psgr	RJ-700	11.8	3.0	2.2
Airline-AC	747	0.1	0.0	0.1
Airline-AC	777	4.7	2.0	5.0
Airline-AC	A330	2.7	1.2	2.9
Airline-AC	DC10/MD11	1.6	0.7	1.7
Airline-AC	A300	0.9	0.4	1.0
Airline-AC	767	1.9	0.8	2.1
Airline-AC	757	0.6	0.3	0.6
Airline-AC	737-3/500	1.0	0.4	1.0
Airline-AC	737-7/900	1.0	0.4	1.0
Airline-AC	AT43/AT72/BA41	1.9	0.9	2.0
Airline-AC	B190/BE99/PA32	4.5	2.1	4.7
Airline-AC	SW4	0.4	0.2	0.5
Airline-AC	PA31/SW3	0.9	0.4	0.9
GA-BJ	C550	10.4	1.4	1.2
GA-BJ	C560	1.9	0.3	0.2
GA-BJ	C750	1.4	0.2	0.2
GA-BJ	CL60	2.8	0.4	0.3
GA-BJ	FA20	1.9	0.3	0.2
GA-BJ	FA50	1.4	0.2	0.2
GA-BJ	GLF4	5.2	0.7	0.6
GA-BJ	H25A	2.4	0.3	0.3
GA-BJ	H25B	3.3	0.4	0.4
GA-BJ	LJ35	3.8	0.5	0.4
GA-BJ	LJ60	0.9	0.1	0.1
GA-BJ	WW24	0.9	0.1	0.1
GA-MEL	BE58	3.1	0.3	0.5
GA-MEL	C310	0.4	0.0	0.1
GA-MEL	C402	0.8	0.1	0.1
GA-MEL	PA31	0.6	0.1	0.1
GA-SEL	C172	11.0	1.2	1.8
GA-SEL	PA32	9.0	1.0	1.5
GA-TP	BE99	6.0	0.7	1.0
GA-TP	G159	7.1	0.8	1.2
GA-TP	P46T	1.2	0.1	0.2
GA-TP	TBM7	2.4	0.3	0.4
Military	C130	0.2	0.0	0.0
Military	F18	0.2	0.0	0.0
Military	F16	0.1	0.0	0.0
Local	C152	19.7	2.2	3.2
Local	C172	16.0	1.8	2.6
Local	PA18	17.6	1.9	2.9
<b>Total</b>		<b>358.41</b>	<b>76.54</b>	<b>82.02</b>

Note: The OAK Demand Management scenario has the same operations as the 2035 Baseline scenario.

Table 12 OAK 2035 Redistribution Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-700/800/900	162.1	40.7	30.9
Airline-Psgr	787-9 / A-350	2.7	0.7	0.5
Airline-Psgr	A-318/319/320/321	27.8	7.0	5.3
Airline-Psgr	RJ-700	11.8	3.0	2.2
Airline-AC	747	0.1	0.0	0.1
Airline-AC	777	4.7	2.0	5.0
Airline-AC	A330	2.7	1.2	2.9
Airline-AC	DC10/MD11	1.6	0.7	1.7
Airline-AC	A300	0.9	0.4	1.0
Airline-AC	767	1.9	0.8	2.1
Airline-AC	757	0.6	0.3	0.6
Airline-AC	737-3/500	1.0	0.4	1.0
Airline-AC	737-7/900	1.0	0.4	1.0
Airline-AC	AT43/AT72/BA41	1.9	0.9	2.0
Airline-AC	B190/BE99/PA32	4.5	2.1	4.7
Airline-AC	SW4	0.4	0.2	0.5
Airline-AC	PA31/SW3	0.9	0.4	0.9
GA-BJ	C550	10.4	1.4	1.2
GA-BJ	C560	1.9	0.3	0.2
GA-BJ	C750	1.4	0.2	0.2
GA-BJ	CL60	2.8	0.4	0.3
GA-BJ	FA20	1.9	0.3	0.2
GA-BJ	FA50	1.4	0.2	0.2
GA-BJ	GLF4	5.2	0.7	0.6
GA-BJ	H25A	2.4	0.3	0.3
GA-BJ	H25B	3.3	0.4	0.4
GA-BJ	LJ35	3.8	0.5	0.4
GA-BJ	LJ60	0.9	0.1	0.1
GA-BJ	WW24	0.9	0.1	0.1
GA-MEL	BE58	3.1	0.3	0.5
GA-MEL	C310	0.4	0.0	0.1
GA-MEL	C402	0.8	0.1	0.1
GA-MEL	PA31	0.6	0.1	0.1
GA-SEL	C172	11.0	1.2	1.8
GA-SEL	PA32	9.0	1.0	1.5
GA-TP	BE99	6.0	0.7	1.0
GA-TP	G159	7.1	0.8	1.2
GA-TP	P46T	1.2	0.1	0.2
GA-TP	TBM7	2.4	0.3	0.4
Military	C130	0.2	0.0	0.0
Military	F18	0.2	0.0	0.0
Military	F16	0.1	0.0	0.0
Local	C152	19.7	2.2	3.2
Local	C172	16.0	1.8	2.6
Local	PA18	17.6	1.9	2.9
<b>Total</b>		<b>358.41</b>	<b>76.54</b>	<b>82.02</b>

Table 13 OAK 2035 Internal Regional Airports Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-700/800/900	135.8	33.9	25.3
Airline-Psgr	787-9 / A-350	2.2	0.6	0.4
Airline-Psgr	A-318/319/320/321	23.6	5.9	4.4
Airline-Psgr	RJ-700	9.8	2.5	1.8
Airline-AC	747	0.1	0.0	0.1
Airline-AC	777	4.7	2.1	5.0
Airline-AC	A330	2.7	1.2	2.9
Airline-AC	DC10/MD11	1.6	0.7	1.7
Airline-AC	A300	0.9	0.4	1.0
Airline-AC	767	1.9	0.8	2.0
Airline-AC	757	0.6	0.3	0.6
Airline-AC	737-3/500	1.0	0.4	1.0
Airline-AC	737-7/900	1.0	0.4	1.0
Airline-AC	AT43/AT72/BA41	1.9	0.9	2.0
Airline-AC	B190/BE99/PA32	4.5	2.0	4.7
Airline-AC	SW4	0.4	0.2	0.5
Airline-AC	PA31/SW3	0.9	0.4	0.9
GA-BJ	C550	10.5	1.4	1.1
GA-BJ	C560	1.9	0.3	0.2
GA-BJ	C750	1.4	0.2	0.2
GA-BJ	CL60	2.9	0.4	0.3
GA-BJ	FA20	1.9	0.3	0.2
GA-BJ	FA50	1.4	0.2	0.2
GA-BJ	GLF4	5.2	0.7	0.6
GA-BJ	H25A	2.4	0.3	0.3
GA-BJ	H25B	3.3	0.4	0.4
GA-BJ	LJ35	3.8	0.5	0.4
GA-BJ	LJ60	1.0	0.1	0.1
GA-BJ	WW24	1.0	0.1	0.1
GA-MEL	BE58	3.1	0.3	0.5
GA-MEL	C310	0.4	0.0	0.1
GA-MEL	C402	0.8	0.1	0.1
GA-MEL	PA31	0.6	0.1	0.1
GA-SEL	C172	11.1	1.2	1.8
GA-SEL	PA32	9.0	1.0	1.4
GA-TP	BE99	6.0	0.6	1.0
GA-TP	G159	7.2	0.8	1.2
GA-TP	P46T	1.2	0.1	0.2
GA-TP	TBM7	2.4	0.3	0.4
Military	C130	0.2	0.0	0.0
Military	F18	0.2	0.0	0.0
Military	F16	0.1	0.0	0.0
Local	C152	19.8	2.1	3.2
Local	C172	16.1	1.7	2.6
Local	PA18	17.7	1.9	2.8
<b>Total</b>		<b>326.3</b>	<b>67.7</b>	<b>74.6</b>

Table 14 OAK 2035 External Regional Airports Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-700/800/900	142.2	35.6	26.6
Airline-Psgr	787-9 / A-350	2.3	0.6	0.4
Airline-Psgr	A-318/319/320/321	24.7	6.2	4.6
Airline-Psgr	RJ-700	10.3	2.6	1.9
Airline-AC	747	0.1	0.0	0.1
Airline-AC	777	4.7	2.1	5.0
Airline-AC	A330	2.7	1.2	2.9
Airline-AC	DC10/MD11	1.6	0.7	1.7
Airline-AC	A300	0.9	0.4	1.0
Airline-AC	767	1.9	0.8	2.0
Airline-AC	757	0.6	0.3	0.6
Airline-AC	737-3/500	1.0	0.4	1.0
Airline-AC	737-7/900	1.0	0.4	1.0
Airline-AC	AT43/AT72/BA41	1.9	0.9	2.0
Airline-AC	B190/BE99/PA32	4.5	2.0	4.7
Airline-AC	SW4	0.4	0.2	0.5
Airline-AC	PA31/SW3	0.9	0.4	0.9
GA-BJ	C550	10.5	1.4	1.1
GA-BJ	C560	1.9	0.3	0.2
GA-BJ	C750	1.4	0.2	0.2
GA-BJ	CL60	2.9	0.4	0.3
GA-BJ	FA20	1.9	0.3	0.2
GA-BJ	FA50	1.4	0.2	0.2
GA-BJ	GLF4	5.2	0.7	0.6
GA-BJ	H25A	2.4	0.3	0.3
GA-BJ	H25B	3.3	0.4	0.4
GA-BJ	LJ35	3.8	0.5	0.4
GA-BJ	LJ60	1.0	0.1	0.1
GA-BJ	WW24	1.0	0.1	0.1
GA-MEL	BE58	3.1	0.3	0.5
GA-MEL	C310	0.4	0.0	0.1
GA-MEL	C402	0.8	0.1	0.1
GA-MEL	PA31	0.6	0.1	0.1
GA-SEL	C172	11.1	1.2	1.8
GA-SEL	PA32	9.0	1.0	1.4
GA-TP	BE99	6.0	0.6	1.0
GA-TP	G159	7.2	0.8	1.2
GA-TP	P46T	1.2	0.1	0.2
GA-TP	TBM7	2.4	0.3	0.4
Military	C130	0.2	0.0	0.0
Military	F18	0.2	0.0	0.0
Military	F16	0.1	0.0	0.0
Local	C152	19.8	2.1	3.2
Local	C172	16.1	1.7	2.6
Local	PA18	17.7	1.9	2.9
<b>Total</b>		<b>334.3</b>	<b>69.8</b>	<b>76.3</b>

Table 15 OAK 2035 Air Traffic Control Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-700/800/900	145.6	36.4	27.1
Airline-Psgr	787-9 / A-350	2.4	0.6	0.4
Airline-Psgr	A-318/319/320/321	25.2	6.3	4.7
Airline-Psgr	RJ-700	10.5	2.6	2.0
Airline-AC	747	0.1	0.0	0.1
Airline-AC	777	4.7	2.1	5.0
Airline-AC	A330	2.7	1.2	2.9
Airline-AC	DC10/MD11	1.6	0.7	1.7
Airline-AC	A300	0.9	0.4	1.0
Airline-AC	767	1.9	0.8	2.0
Airline-AC	757	0.6	0.3	0.6
Airline-AC	737-3/500	1.0	0.4	1.0
Airline-AC	737-7/900	1.0	0.4	1.0
Airline-AC	AT43/AT72/BA41	1.9	0.9	2.0
Airline-AC	B190/BE99/PA32	4.5	2.0	4.7
Airline-AC	SW4	0.4	0.2	0.5
Airline-AC	PA31/SW3	0.9	0.4	0.9
GA-BJ	C550	10.5	1.4	1.1
GA-BJ	C560	1.9	0.3	0.2
GA-BJ	C750	1.4	0.2	0.2
GA-BJ	CL60	2.9	0.4	0.3
GA-BJ	FA20	1.9	0.3	0.2
GA-BJ	FA50	1.4	0.2	0.2
GA-BJ	GLF4	5.2	0.7	0.6
GA-BJ	H25A	2.4	0.3	0.3
GA-BJ	H25B	3.3	0.4	0.4
GA-BJ	LJ35	3.8	0.5	0.4
GA-BJ	LJ60	1.0	0.1	0.1
GA-BJ	WW24	1.0	0.1	0.1
GA-MEL	BE58	3.1	0.3	0.5
GA-MEL	C310	0.4	0.0	0.1
GA-MEL	C402	0.8	0.1	0.1
GA-MEL	PA31	0.6	0.1	0.1
GA-SEL	C172	11.1	1.2	1.8
GA-SEL	PA32	9.0	1.0	1.4
GA-TP	BE99	6.0	0.6	1.0
GA-TP	G159	7.2	0.8	1.2
GA-TP	P46T	1.2	0.1	0.2
GA-TP	TBM7	2.4	0.3	0.4
Military	C130	0.2	0.0	0.0
Military	F18	0.2	0.0	0.0
Military	F16	0.1	0.0	0.0
Local	C152	19.8	2.1	3.2
Local	C172	16.1	1.7	2.6
Local	PA18	17.7	1.9	2.8
<b>Total</b>		<b>338.6</b>	<b>70.7</b>	<b>76.9</b>

Table 16 OAK 2035 High Speed Rail Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-700/800/900	129.8	32.4	24.1
Airline-Psgr	787-9 / A-350	2.4	0.6	0.4
Airline-Psgr	A-318/319/320/321	23.4	5.9	4.4
Airline-Psgr	RJ-700	10.5	2.6	2.0
Airline-AC	747	0.1	0.0	0.1
Airline-AC	777	4.7	2.1	5.0
Airline-AC	A330	2.7	1.2	2.9
Airline-AC	DC10/MD11	1.6	0.7	1.7
Airline-AC	A300	0.9	0.4	1.0
Airline-AC	767	1.9	0.8	2.0
Airline-AC	757	0.6	0.3	0.6
Airline-AC	737-3/500	1.0	0.4	1.0
Airline-AC	737-7/900	1.0	0.4	1.0
Airline-AC	AT43/AT72/BA41	1.9	0.9	2.0
Airline-AC	B190/BE99/PA32	4.5	2.0	4.7
Airline-AC	SW4	0.4	0.2	0.4
Airline-AC	PA31/SW3	0.9	0.4	0.9
GA-BJ	C550	10.5	1.4	1.1
GA-BJ	C560	1.9	0.3	0.2
GA-BJ	C750	1.4	0.2	0.2
GA-BJ	CL60	2.9	0.4	0.3
GA-BJ	FA20	1.9	0.3	0.2
GA-BJ	FA50	1.4	0.2	0.2
GA-BJ	GLF4	5.2	0.7	0.6
GA-BJ	H25A	2.4	0.3	0.3
GA-BJ	H25B	3.3	0.4	0.4
GA-BJ	LJ35	3.8	0.5	0.4
GA-BJ	LJ60	1.0	0.1	0.1
GA-BJ	WW24	1.0	0.1	0.1
GA-MEL	BE58	3.1	0.3	0.5
GA-MEL	C310	0.4	0.0	0.1
GA-MEL	C402	0.8	0.1	0.1
GA-MEL	PA31	0.6	0.1	0.1
GA-SEL	C172	11.1	1.2	1.8
GA-SEL	PA32	9.0	1.0	1.4
GA-TP	BE99	6.0	0.6	1.0
GA-TP	G159	7.2	0.8	1.2
GA-TP	P46T	1.2	0.1	0.2
GA-TP	TBM7	2.4	0.3	0.4
Military	C130	0.2	0.0	0.0
Military	F18	0.2	0.0	0.0
Military	F16	0.1	0.0	0.0
Local	C152	19.8	2.1	3.2
Local	C172	16.1	1.7	2.6
Local	PA18	17.7	1.9	2.8
<b>Total</b>		<b>321.1</b>	<b>66.3</b>	<b>73.5</b>

Table 17 SFO 2007 Existing Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr-Dom	A-318/319/320/321	71.4	11.8	13.3
Airline-Psgr-Dom	EMB-120	49.8	8.2	9.5
Airline-Psgr-Dom	757 (all)	43.4	7.2	8.1
Airline-Psgr-Dom	RJ-200/ER	24.6	4.1	4.6
Airline-Psgr-Dom	737-700/800/900	24.2	4.0	4.5
Airline-Psgr-Dom	767 (all)	17.7	2.9	3.3
Airline-Psgr-Dom	737-300	17.0	2.8	3.2
Airline-Psgr-Dom	MD-80 (all)	15.4	2.6	2.9
Airline-Psgr-Dom	737-400/500	14.7	2.4	2.7
Airline-Psgr-Dom	RJ-700	13.2	2.2	2.5
Airline-Psgr-Dom	777 (all)	4.4	0.7	0.8
Airline-Psgr-Dom	EMB-140	3.4	0.6	0.6
Airline-Psgr-Dom	EMB-145/ERJ-145	2.4	0.4	0.4
Airline-Psgr-Dom	EMB-190	1.4	0.2	0.3
Airline-Psgr-Dom	EMB-170	0.5	0.1	0.1
Airline-Psgr-Dom	RJ-900	0.4	0.1	0.1
Airline-Psgr-Intl	747 (all)	17.4	2.5	0.8
Airline-Psgr-Intl	777 (all)	9.2	1.3	0.4
Airline-Psgr-Intl	A-330/340	3.7	0.5	0.2
Airline-AC	747 (all)	3.3	0.9	4.0
Airline-AC	777 (all)	0.0	0.0	0.0
Airline-AC	DC10/MD11	1.2	0.3	1.4
Airline-AC	A300	0.1	0.0	0.1
Airline-AC	767 (all)	0.5	0.1	0.6
Airline-AC	757 (all)	0.0	0.0	0.0
Airline-AC	DC8	0.0	0.0	0.0
Airline-AC	DC9	0.3	0.1	0.3
Airline-AC	737-200/300	0.0	0.0	0.0
GA-BJ	C750	3.7	0.4	0.3
GA-BJ	C56X	3.0	0.3	0.3
GA-BJ	GLF4	2.8	0.3	0.2
GA-BJ	H25B	2.5	0.2	0.2
GA-BJ	C560	2.4	0.2	0.2
GA-BJ	BE40	2.1	0.2	0.2
GA-BJ	CL60	2.0	0.2	0.2
GA-BJ	F2TH	1.5	0.1	0.1
GA-BJ	GALX	1.3	0.1	0.1
GA-BJ	F900	1.1	0.1	0.1
GA-BJ	CL30	1.1	0.1	0.1
GA-BJ	GLF5	1.0	0.1	0.1
GA-BJ	C550	0.9	0.1	0.1
GA-BJ	LJ60	0.8	0.1	0.1
GA-BJ	C680	0.8	0.1	0.1
GA-BJ	LJ35	0.7	0.1	0.1
GA-BJ	FA50	0.7	0.1	0.1
GA-BJ	GLF3	0.6	0.1	0.1
GA-BJ	LJ45	0.6	0.1	0.1

Table 17 SFO 2007 Existing Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
GA-BJ	GLEX	0.5	0.0	0.0
GA-BJ	PRM1	0.4	0.0	0.0
GA-BJ	LJ55	0.4	0.0	0.0
GA-BJ	C525	0.4	0.0	0.0
GA-BJ	C25B	0.4	0.0	0.0
GA-BJ	C650	0.3	0.0	0.0
GA-BJ	GLF2	0.2	0.0	0.0
GA-MEL	C421	2.9	0.4	0.6
GA-SEL	C182	0.2	0.0	0.0
GA-SEL	C150	0.1	0.0	0.0
GA-SEL	C172	0.1	0.0	0.0
GA-SEL	BE36	0.1	0.0	0.0
GA-TP	BE20	1.1	0.2	0.2
GA-TP	B350	0.6	0.1	0.1
GA-TP	P180	0.5	0.1	0.1
GA-TP	PAY2	0.4	0.1	0.1
GA-TP	BE30	0.3	0.0	0.1
GA-TP	BE9L	0.3	0.0	0.1
Military	C130	1.4	0.2	0.3
Military	F18	1.3	0.2	0.2
Local	C172	0.1	0.0	0.0
<b>Total</b>		<b>380.9</b>	<b>60.5</b>	<b>69.5</b>

Table 18 SFO 2035 Baseline Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr-Dom	A-318/319/320/321	160.4	27.2	32.4
Airline-Psgr-Dom	737-700/800/900	139.2	23.6	28.1
Airline-Psgr-Dom	RJ-700	36.1	6.1	7.3
Airline-Psgr-Dom	787-9 / A-350	20.8	3.5	4.2
Airline-Psgr-Dom	DHC-8-400	19.4	3.3	4.3
Airline-Psgr-Dom	777 (all)	10.5	1.8	2.1
Airline-Psgr-Dom	EMB-170	5.7	1.0	1.2
Airline-Psgr-Intl	747 (all)	31.6	4.6	1.5
Airline-Psgr-Intl	777 (all)	17.8	2.6	0.9
Airline-Psgr-Intl	787-9 / A-350	16.8	2.4	0.8
Airline-Psgr-Intl	A-380	8.5	1.2	0.4
Airline-Psgr-Intl	A-330/340	3.5	0.5	0.2
Airline-AC	747	6.1	1.7	8.1
Airline-AC	777	1.6	0.4	2.2
Airline-AC	A330	0.2	0.0	0.2
Airline-AC	DC10/MD11	0.5	0.1	0.7
Airline-AC	767	1.0	0.3	1.3
Airline-AC	737-3/4/500	0.3	0.1	0.3
Airline-AC	737-7/8/900	0.3	0.1	0.3
GA-BJ	C750	5.4	0.5	0.5
GA-BJ	C56X	4.3	0.4	0.4
GA-BJ	GLF4	4.0	0.4	0.4
GA-BJ	H25B	3.6	0.4	0.3
GA-BJ	C560	3.4	0.3	0.3
GA-BJ	BE40	3.1	0.3	0.3
GA-BJ	CL60	2.8	0.3	0.3
GA-BJ	F2TH	2.2	0.2	0.2
GA-BJ	GALX	1.8	0.2	0.2
GA-BJ	F900	1.6	0.2	0.2
GA-BJ	CL30	1.6	0.2	0.2
GA-BJ	GLF5	1.4	0.1	0.1
GA-BJ	C550	1.3	0.1	0.1
GA-BJ	LJ60	1.1	0.1	0.1
GA-BJ	C680	1.1	0.1	0.1
GA-BJ	LJ35	1.0	0.1	0.1
GA-BJ	FA50	1.0	0.1	0.1
GA-BJ	LJ45	0.9	0.1	0.1
GA-BJ	GLEX	0.7	0.1	0.1
GA-BJ	PRM1	0.6	0.1	0.1
GA-BJ	LJ55	0.5	0.1	0.1
GA-BJ	C525	0.5	0.1	0.1
GA-BJ	C25B	0.5	0.1	0.0
GA-BJ	C650	0.4	0.0	0.0
GA-MEL	C421	1.3	0.2	0.3
GA-SEL	C182	0.2	0.0	0.0
GA-SEL	C150	0.1	0.0	0.0
GA-SEL	C172	0.1	0.0	0.0

**Table 18 SFO 2035 Baseline Average Daily Landing & Takeoff Cycles**

<b>Category</b>	<b>Aircraft</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
GA-SEL	BE36	0.1	0.0	0.0
GA-TP	BE20	1.0	0.1	0.2
GA-TP	B350	0.5	0.1	0.1
GA-TP	P180	0.5	0.1	0.1
GA-TP	PAY2	0.3	0.0	0.1
GA-TP	BE30	0.3	0.0	0.1
GA-TP	BE9L	0.3	0.0	0.1
Military	C130	1.4	0.2	0.3
Military	F18	1.3	0.2	0.3
Local	C172	0.0	0.0	0.0
<b>Total</b>		<b>532.5</b>	<b>86.3</b>	<b>102.5</b>

Table 19 SFO 2035 Redistribution Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr-Dom	737-700/800/900	126.4	21.3	24.7
Airline-Psgr-Dom	777 (all)	9.5	1.6	1.9
Airline-Psgr-Dom	787-9 / A-350	18.8	3.2	3.7
Airline-Psgr-Dom	A-318/319/320/321	146.7	24.7	28.7
Airline-Psgr-Dom	DHC-8-400	17.6	3.0	3.7
Airline-Psgr-Dom	EMB-170	5.2	0.9	1.0
Airline-Psgr-Dom	RJ-700	32.8	5.5	6.4
Airline-Psgr-Intl	747 (all)	31.7	4.6	1.5
Airline-Psgr-Intl	777 (all)	17.8	2.6	0.8
Airline-Psgr-Intl	787-9 / A-350	16.9	2.4	0.8
Airline-Psgr-Intl	A-380	8.5	1.2	0.4
Airline-Psgr-Intl	A-330/340	3.5	0.5	0.2
Airline-AC	747	6.2	1.7	8.0
Airline-AC	777	1.7	0.5	2.1
Airline-AC	A330	0.2	0.1	0.2
Airline-AC	DC10/MD11	0.6	0.2	0.7
Airline-AC	767	1.0	0.3	1.3
Airline-AC	737-3/4/500	0.3	0.1	0.3
Airline-AC	737-7/8/900	0.3	0.1	0.3
GA-BJ	C750	5.4	0.5	0.5
GA-BJ	C56X	4.3	0.4	0.4
GA-BJ	GLF4	4.0	0.4	0.4
GA-BJ	H25B	3.6	0.4	0.3
GA-BJ	C560	3.5	0.3	0.3
GA-BJ	BE40	3.1	0.3	0.3
GA-BJ	CL60	2.8	0.3	0.3
GA-BJ	F2TH	2.2	0.2	0.2
GA-BJ	GALX	1.8	0.2	0.2
GA-BJ	F900	1.6	0.2	0.2
GA-BJ	CL30	1.6	0.2	0.1
GA-BJ	GLF5	1.4	0.1	0.1
GA-BJ	C550	1.4	0.1	0.1
GA-BJ	LJ60	1.1	0.1	0.1
GA-BJ	C680	1.1	0.1	0.1
GA-BJ	LJ35	1.0	0.1	0.1
GA-BJ	FA50	1.0	0.1	0.1
GA-BJ	LJ45	0.9	0.1	0.1
GA-BJ	GLEX	0.7	0.1	0.1
GA-BJ	PRM1	0.6	0.1	0.1
GA-BJ	LJ55	0.5	0.1	0.0
GA-BJ	C525	0.5	0.1	0.0
GA-BJ	C25B	0.5	0.1	0.0
GA-BJ	C650	0.4	0.0	0.0
GA-MEL	C421	1.3	0.2	0.3
GA-SEL	C182	0.2	0.0	0.0
GA-SEL	C150	0.1	0.0	0.0
GA-SEL	C172	0.1	0.0	0.0

**Table 19 SFO 2035 Redistribution Average Daily Landing & Takeoff Cycles**

<b>Category</b>	<b>Aircraft</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
GA-SEL	BE36	0.1	0.0	0.0
GA-TP	BE20	1.0	0.1	0.2
GA-TP	B350	0.5	0.1	0.1
GA-TP	P180	0.5	0.1	0.1
GA-TP	PAY2	0.3	0.0	0.1
GA-TP	BE30	0.3	0.0	0.1
GA-TP	BE9L	0.3	0.0	0.1
Military	C130	1.4	0.2	0.3
Military	F18	1.3	0.2	0.3
Local	C172	0.0	0.0	0.0
<b>Total</b>		<b>498.0</b>	<b>79.8</b>	<b>92.4</b>

Table 20 SFO 2035 Internal Regional Airports Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr-Dom	A-318/319/320/321	156.6	26.5	31.4
Airline-Psgr-Dom	737-700/800/900	135.6	23.0	27.2
Airline-Psgr-Dom	RJ-700	35.4	6.0	7.1
Airline-Psgr-Dom	787-9 / A-350	20.3	3.4	4.1
Airline-Psgr-Dom	DHC-8-400	18.9	3.2	4.1
Airline-Psgr-Dom	777 (all)	10.2	1.7	2.0
Airline-Psgr-Dom	EMB-170	5.4	0.9	1.1
Airline-Psgr-Intl	747 (all)	31.6	4.6	1.5
Airline-Psgr-Intl	777 (all)	17.8	2.6	0.9
Airline-Psgr-Intl	787-9 / A-350	16.8	2.4	0.8
Airline-Psgr-Intl	A-380	8.5	1.2	0.4
Airline-Psgr-Intl	A-330/340	3.5	0.5	0.2
Airline-AC	747	6.1	1.7	8.1
Airline-AC	777	1.6	0.5	2.2
Airline-AC	A330	0.2	0.1	0.2
Airline-AC	DC10/MD11	0.5	0.1	0.7
Airline-AC	767	1.0	0.3	1.3
Airline-AC	737-3/4/500	0.3	0.1	0.3
Airline-AC	737-7/8/900	0.3	0.1	0.3
GA-BJ	C750	5.4	0.5	0.5
GA-BJ	C56X	4.3	0.4	0.4
GA-BJ	GLF4	4.0	0.4	0.4
GA-BJ	H25B	3.6	0.4	0.3
GA-BJ	C560	3.4	0.3	0.3
GA-BJ	BE40	3.1	0.3	0.3
GA-BJ	CL60	2.8	0.3	0.3
GA-BJ	F2TH	2.2	0.2	0.2
GA-BJ	GALX	1.8	0.2	0.2
GA-BJ	F900	1.6	0.2	0.2
GA-BJ	CL30	1.6	0.2	0.2
GA-BJ	GLF5	1.4	0.1	0.1
GA-BJ	C550	1.4	0.1	0.1
GA-BJ	LJ60	1.1	0.1	0.1
GA-BJ	C680	1.1	0.1	0.1
GA-BJ	LJ35	1.0	0.1	0.1
GA-BJ	FA50	1.0	0.1	0.1
GA-BJ	LJ45	0.9	0.1	0.1
GA-BJ	GLEX	0.7	0.1	0.1
GA-BJ	PRM1	0.6	0.1	0.1
GA-BJ	LJ55	0.5	0.1	0.1
GA-BJ	C525	0.5	0.1	0.0
GA-BJ	C25B	0.5	0.1	0.0
GA-BJ	C650	0.4	0.0	0.0
GA-MEL	C421	1.3	0.2	0.3
GA-SEL	C182	0.2	0.0	0.0
GA-SEL	C150	0.1	0.0	0.0
GA-SEL	C172	0.1	0.0	0.0

**Table 20 SFO 2035 Internal Regional Airports Average Daily Landing & Takeoff Cycles**

<b>Category</b>	<b>Aircraft</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
GA-SEL	BE36	0.1	0.0	0.0
GA-TP	BE20	1.0	0.1	0.2
GA-TP	B350	0.5	0.1	0.1
GA-TP	P180	0.5	0.1	0.1
GA-TP	PAY2	0.3	0.0	0.1
GA-TP	BE30	0.3	0.0	0.1
GA-TP	BE9L	0.3	0.0	0.1
Military	C130	1.4	0.2	0.3
Military	F18	1.3	0.2	0.3
Local	C172	0.0	0.0	0.0
<b>Total</b>		<b>444.0</b>	<b>71.1</b>	<b>83.9</b>

Table 21 SFO 2035 External Regional Airports Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr-Dom	A-318/319/320/321	159.0	27.0	32.0
Airline-Psgr-Dom	737-700/800/900	137.9	23.4	27.7
Airline-Psgr-Dom	RJ-700	36.0	6.1	7.2
Airline-Psgr-Dom	787-9 / A-350	20.6	3.5	4.2
Airline-Psgr-Dom	DHC-8-400	19.2	3.2	4.2
Airline-Psgr-Dom	777 (all)	10.4	1.8	2.1
Airline-Psgr-Dom	EMB-170	5.5	0.9	1.1
Airline-Psgr-Intl	747 (all)	31.6	4.6	1.5
Airline-Psgr-Intl	777 (all)	17.8	2.6	0.9
Airline-Psgr-Intl	787-9 / A-350	16.8	2.4	0.8
Airline-Psgr-Intl	A-380	8.5	1.2	0.4
Airline-Psgr-Intl	A-330/340	3.5	0.5	0.2
Airline-AC	747	6.1	1.7	8.1
Airline-AC	777	1.6	0.4	2.2
Airline-AC	A330	0.2	0.0	0.2
Airline-AC	DC10/MD11	0.5	0.1	0.7
Airline-AC	767	1.0	0.3	1.3
Airline-AC	737-3/4/500	0.3	0.1	0.3
Airline-AC	737-7/8/900	0.3	0.1	0.3
GA-BJ	C750	5.4	0.5	0.5
GA-BJ	C56X	4.3	0.4	0.4
GA-BJ	GLF4	4.0	0.4	0.4
GA-BJ	H25B	3.6	0.4	0.3
GA-BJ	C560	3.4	0.3	0.3
GA-BJ	BE40	3.1	0.3	0.3
GA-BJ	CL60	2.8	0.3	0.3
GA-BJ	F2TH	2.2	0.2	0.2
GA-BJ	GALX	1.8	0.2	0.2
GA-BJ	F900	1.6	0.2	0.2
GA-BJ	CL30	1.6	0.2	0.2
GA-BJ	GLF5	1.4	0.1	0.1
GA-BJ	C550	1.3	0.1	0.1
GA-BJ	LJ60	1.1	0.1	0.1
GA-BJ	C680	1.1	0.1	0.1
GA-BJ	LJ35	1.0	0.1	0.1
GA-BJ	FA50	1.0	0.1	0.1
GA-BJ	LJ45	0.9	0.1	0.1
GA-BJ	GLEX	0.7	0.1	0.1
GA-BJ	PRM1	0.6	0.1	0.1
GA-BJ	LJ55	0.5	0.1	0.1
GA-BJ	C525	0.5	0.1	0.0
GA-BJ	C25B	0.5	0.1	0.0
GA-BJ	C650	0.4	0.0	0.0
GA-MEL	C421	1.3	0.2	0.3
GA-SEL	C182	0.2	0.0	0.0
GA-SEL	C150	0.1	0.0	0.0
GA-SEL	C172	0.1	0.0	0.0

**Table 21 SFO 2035 External Regional Airports Average Daily Landing & Takeoff Cycles**

<b>Category</b>	<b>Aircraft</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
GA-SEL	BE36	0.1	0.0	0.0
GA-TP	BE20	1.0	0.1	0.2
GA-TP	B350	0.5	0.1	0.1
GA-TP	P180	0.5	0.1	0.1
GA-TP	PAY2	0.3	0.0	0.1
GA-TP	BE30	0.3	0.0	0.1
GA-TP	BE9L	0.3	0.0	0.1
Military	C130	1.4	0.2	0.3
Military	F18	1.3	0.2	0.3
Local	C172	0.0	0.0	0.0
<b>Total</b>		<b>529.1</b>	<b>85.5</b>	<b>101.4</b>

Table 22 SFO 2035 Air Traffic Control Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr-Dom	A-318/319/320/321	162.2	27.1	30.8
Airline-Psgr-Dom	737-700/800/900	140.7	23.5	26.7
Airline-Psgr-Dom	RJ-700	36.5	6.1	6.9
Airline-Psgr-Dom	787-9 / A-350	21.1	3.5	4.0
Airline-Psgr-Dom	DHC-8-400	19.7	3.3	3.9
Airline-Psgr-Dom	777 (all)	10.6	1.8	2.0
Airline-Psgr-Dom	EMB-170	5.8	1.0	1.1
Airline-Psgr-Intl	747 (all)	31.7	4.5	1.4
Airline-Psgr-Intl	777 (all)	17.9	2.5	0.8
Airline-Psgr-Intl	787-9 / A-350	16.9	2.4	0.8
Airline-Psgr-Intl	A-380	8.5	1.2	0.4
Airline-Psgr-Intl	A-330/340	3.5	0.5	0.2
Airline-AC	747	6.3	1.7	7.9
Airline-AC	777	1.7	0.5	2.1
Airline-AC	A330	0.2	0.1	0.2
Airline-AC	DC10/MD11	0.6	0.2	0.7
Airline-AC	767	1.0	0.3	1.3
Airline-AC	737-3/4/500	0.3	0.1	0.3
Airline-AC	737-7/8/900	0.3	0.1	0.3
GA-BJ	C750	5.4	0.5	0.5
GA-BJ	C56X	4.3	0.4	0.4
GA-BJ	GLF4	4.0	0.4	0.4
GA-BJ	H25B	3.6	0.4	0.3
GA-BJ	C560	3.5	0.3	0.3
GA-BJ	BE40	3.1	0.3	0.3
GA-BJ	CL60	2.8	0.3	0.3
GA-BJ	F2TH	2.2	0.2	0.2
GA-BJ	GALX	1.8	0.2	0.2
GA-BJ	F900	1.6	0.2	0.1
GA-BJ	CL30	1.6	0.2	0.1
GA-BJ	GLF5	1.4	0.1	0.1
GA-BJ	C550	1.4	0.1	0.1
GA-BJ	LJ60	1.1	0.1	0.1
GA-BJ	C680	1.1	0.1	0.1
GA-BJ	LJ35	1.0	0.1	0.1
GA-BJ	FA50	1.0	0.1	0.1
GA-BJ	LJ45	0.9	0.1	0.1
GA-BJ	GLEX	0.7	0.1	0.1
GA-BJ	PRM1	0.6	0.1	0.1
GA-BJ	LJ55	0.5	0.1	0.0
GA-BJ	C525	0.5	0.1	0.0
GA-BJ	C25B	0.5	0.1	0.0
GA-BJ	C650	0.4	0.0	0.0
GA-MEL	C421	1.3	0.2	0.3
GA-SEL	C182	0.2	0.0	0.0
GA-SEL	C150	0.1	0.0	0.0
GA-SEL	C172	0.1	0.0	0.0

**Table 22 SFO 2035 Air Traffic Control Average Daily Landing & Takeoff Cycles**

<b>Category</b>	<b>Aircraft</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
GA-SEL	BE36	0.1	0.0	0.0
GA-TP	BE20	1.0	0.1	0.2
GA-TP	B350	0.5	0.1	0.1
GA-TP	P180	0.5	0.1	0.1
GA-TP	PAY2	0.3	0.0	0.1
GA-TP	BE30	0.3	0.0	0.1
GA-TP	BE9L	0.3	0.0	0.1
Military	C130	1.4	0.2	0.3
Military	F18	1.3	0.2	0.2
Local	C172	0.0	0.0	0.0
<b>Total</b>		<b>538.1</b>	<b>85.9</b>	<b>97.4</b>

Table 23 SFO 2035 High Speed Rail Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr-Dom	A-318/319/320/321	151.33	25.56	29.88
Airline-Psgr-Dom	737-700/800/900	130.33	22.02	25.73
Airline-Psgr-Dom	RJ-700	33.55	5.67	6.62
Airline-Psgr-Dom	787-9 / A-350	20.93	3.54	4.13
Airline-Psgr-Dom	DHC-8-400	16.61	2.80	3.53
Airline-Psgr-Dom	777 (all)	10.56	1.78	2.08
Airline-Psgr-Dom	EMB-170	2.62	0.44	0.52
Airline-Psgr-Intl	747 (all)	31.66	4.56	1.50
Airline-Psgr-Intl	777 (all)	17.83	2.57	0.84
Airline-Psgr-Intl	787-9 / A-350	16.84	2.43	0.80
Airline-Psgr-Intl	A-380	8.48	1.22	0.40
Airline-Psgr-Intl	A-330/340	3.54	0.51	0.17
Airline-AC	747	6.19	1.69	8.02
Airline-AC	777	1.66	0.45	2.15
Airline-AC	A330	0.18	0.05	0.24
Airline-AC	DC10/MD11	0.55	0.15	0.71
Airline-AC	767	1.00	0.27	1.29
Airline-AC	737-3/4/500	0.27	0.07	0.34
Airline-AC	737-7/8/900	0.27	0.07	0.34
GA-BJ	C750	5.38	0.54	0.51
GA-BJ	C56X	4.29	0.43	0.40
GA-BJ	GLF4	4.00	0.40	0.38
GA-BJ	H25B	3.63	0.36	0.34
GA-BJ	C560	3.45	0.34	0.32
GA-BJ	BE40	3.06	0.31	0.29
GA-BJ	CL60	2.82	0.28	0.27
GA-BJ	F2TH	2.21	0.22	0.21
GA-BJ	GALX	1.84	0.18	0.17
GA-BJ	F900	1.63	0.16	0.15
GA-BJ	CL30	1.58	0.16	0.15
GA-BJ	GLF5	1.40	0.14	0.13
GA-BJ	C550	1.35	0.14	0.13
GA-BJ	LJ60	1.10	0.11	0.10
GA-BJ	C680	1.10	0.11	0.10
GA-BJ	LJ35	0.99	0.10	0.09
GA-BJ	FA50	0.97	0.10	0.09
GA-BJ	LJ45	0.93	0.09	0.09
GA-BJ	GLEX	0.71	0.07	0.07
GA-BJ	PRM1	0.61	0.06	0.06
GA-BJ	LJ55	0.53	0.05	0.05
GA-BJ	C525	0.52	0.05	0.05
GA-BJ	C25B	0.51	0.05	0.05
GA-BJ	C650	0.45	0.04	0.04
GA-MEL	C421	1.27	0.18	0.27
GA-SEL	C182	0.17	0.02	0.04
GA-SEL	C150	0.10	0.01	0.02
GA-SEL	C172	0.08	0.01	0.02

Table 23 SFO 2035 High Speed Rail Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
GA-SEL	BE36	0.06	0.01	0.01
GA-TP	BE20	1.00	0.14	0.21
GA-TP	B350	0.48	0.07	0.10
GA-TP	P180	0.46	0.06	0.10
GA-TP	PAY2	0.32	0.05	0.07
GA-TP	BE30	0.30	0.04	0.06
GA-TP	BE9L	0.30	0.04	0.06
Military	C130	1.41	0.24	0.30
Military	F18	1.28	0.22	0.25
Local	C172	0.00	0.00	0.00
<b>Total</b>		<b>506.69</b>	<b>81.45</b>	<b>95.07</b>

**Table 24 SFO 2035 Demand Management Average Daily Landing & Takeoff Cycles**

Category	Aircraft	Day	Evening	Night
Airline-Psgr-Dom	737-700/800/900	139.7	23.6	27.6
Airline-Psgr-Dom	777 (all)	10.6	1.8	2.1
Airline-Psgr-Dom	787-9 / A-350	20.9	3.5	4.1
Airline-Psgr-Dom	A-318/319/320/321	161.0	27.2	31.8
Airline-Psgr-Dom	DHC-8-400	8.9	1.5	1.9
Airline-Psgr-Dom	EMB-170	3.7	0.6	0.7
Airline-Psgr-Dom	EMB-190	13.1	2.2	2.6
Airline-Psgr-Dom	RJ-700	24.2	4.1	4.8
Airline-Psgr-Intl	747 (all)	31.7	4.6	1.5
Airline-Psgr-Intl	777 (all)	17.8	2.6	0.8
Airline-Psgr-Intl	787-9 / A-350	16.8	2.4	0.8
Airline-Psgr-Intl	A-330/340	3.5	0.5	0.2
Airline-Psgr-Intl	A-380	8.5	1.2	0.4
Airline-AC	747	6.2	1.7	8.0
Airline-AC	777	1.7	0.5	2.2
Airline-AC	A330	0.2	0.1	0.2
Airline-AC	DC10/MD11	0.6	0.1	0.7
Airline-AC	767	1.0	0.3	1.3
Airline-AC	737-3/4/500	0.3	0.1	0.3
Airline-AC	737-7/8/900	0.3	0.1	0.3
GA-BJ	C750	4.2	0.4	0.4
GA-BJ	C56X	3.3	0.3	0.3
GA-BJ	GLF4	3.1	0.3	0.3
GA-BJ	H25B	2.8	0.3	0.3
GA-BJ	C560	2.7	0.3	0.3
GA-BJ	BE40	2.4	0.2	0.2
GA-BJ	CL60	2.2	0.2	0.2
GA-BJ	F2TH	1.7	0.2	0.2
GA-BJ	GALX	1.4	0.1	0.1
GA-BJ	F900	1.3	0.1	0.1
GA-BJ	CL30	1.2	0.1	0.1
GA-BJ	GLF5	1.1	0.1	0.1
GA-BJ	C550	1.1	0.1	0.1
GA-BJ	LJ60	0.9	0.1	0.1
GA-BJ	C680	0.9	0.1	0.1
GA-BJ	LJ35	0.8	0.1	0.1
GA-BJ	FA50	0.8	0.1	0.1
GA-BJ	LJ45	0.7	0.1	0.1
GA-BJ	GLEX	0.6	0.1	0.1
GA-BJ	PRM1	0.5	0.0	0.0
GA-BJ	LJ55	0.4	0.0	0.0
GA-BJ	C525	0.4	0.0	0.0
GA-BJ	C25B	0.4	0.0	0.0
GA-BJ	C650	0.3	0.0	0.0
GA-MEL	C421	1.0	0.1	0.2
GA-SEL	C182	0.1	0.0	0.0
GA-SEL	C150	0.1	0.0	0.0

Table 24 SFO 2035 Demand Management Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
GA-SEL	C172	0.1	0.0	0.0
GA-SEL	BE36	0.1	0.0	0.0
GA-TP	BE20	0.8	0.1	0.2
GA-TP	B350	0.4	0.1	0.1
GA-TP	P180	0.4	0.1	0.1
GA-TP	PAY2	0.3	0.0	0.1
GA-TP	BE30	0.2	0.0	0.1
GA-TP	BE9L	0.2	0.0	0.1
Military	C130	1.4	0.2	0.3
Military	F18	1.3	0.2	0.3
Local	C172	0.0	0.0	0.0
<b>Total</b>		<b>512.0</b>	<b>83.1</b>	<b>97.1</b>

Table 25 SJC 2007 Existing Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-300	28.7	8.0	2.8
Airline-Psgr	737-400/500	3.5	1.0	0.3
Airline-Psgr	737-700/800/900	34.6	9.7	3.4
Airline-Psgr	757 (all)	3.3	0.9	0.3
Airline-Psgr	767 (all)	0.7	0.2	0.1
Airline-Psgr	A-318/319/320/321	14.4	4.0	1.4
Airline-Psgr	DHC-8-100	0.0	0.0	0.0
Airline-Psgr	DHC-8-400	2.0	0.6	0.2
Airline-Psgr	EMB-120	3.0	0.8	0.3
Airline-Psgr	EMB-140	16.6	4.6	1.6
Airline-Psgr	EMB-145/ERJ-145	1.5	0.4	0.1
Airline-Psgr	EMB-170	0.2	0.1	0.0
Airline-Psgr	EMB-190	0.0	0.0	0.0
Airline-Psgr	MD-80 (all)	11.6	3.2	1.1
Airline-Psgr	RJ-200/ER	4.7	1.3	0.5
Airline-Psgr	RJ-700	1.6	0.4	0.2
Airline-Psgr	RJ-900	0.8	0.2	0.1
Airline-Psgr	SF-340	0.0	0.0	0.0
Airline-AC	DC10/MD11	0.8	0.3	0.1
Airline-AC	A300	0.3	0.1	0.0
Airline-AC	767 (all)	0.9	0.4	0.1
Airline-AC	757 (all)	0.3	0.1	0.0
Airline-AC	DC8	0.4	0.2	0.0
Airline-AC	DC9	0.0	0.0	0.0
Airline-AC	737-200/300	0.0	0.0	0.0
GA-BJ	ASTR	0.3	0.0	0.0
GA-BJ	BE40	2.7	0.3	0.3
GA-BJ	C525	0.8	0.1	0.1
GA-BJ	C550	1.0	0.1	0.1
GA-BJ	C560	2.6	0.3	0.3
GA-BJ	C56X	2.8	0.3	0.3
GA-BJ	C650	0.5	0.1	0.1
GA-BJ	C680	0.5	0.1	0.1
GA-BJ	C750	3.1	0.4	0.4
GA-BJ	CL30	1.0	0.1	0.1
GA-BJ	CL60	1.2	0.1	0.1
GA-BJ	F2TH	2.0	0.3	0.3
GA-BJ	F900	1.4	0.2	0.2
GA-BJ	FA50	0.4	0.1	0.1
GA-BJ	GALX	1.0	0.1	0.1
GA-BJ	GL5T	0.3	0.0	0.0
GA-BJ	GLEK	0.6	0.1	0.1
GA-BJ	GLF3	0.4	0.0	0.0
GA-BJ	GLF4	2.6	0.3	0.3
GA-BJ	GLF5	1.5	0.2	0.2
GA-BJ	H25B	2.1	0.3	0.3
GA-BJ	LJ35	0.5	0.1	0.1

Table 25 SJC 2007 Existing Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
GA-BJ	LJ45	0.4	0.0	0.0
GA-BJ	LJ60	0.7	0.1	0.1
GA-BJ	PRM1	0.5	0.1	0.1
GA-BJ	SBR1	0.3	0.0	0.0
GA-BJ	WW24	0.3	0.0	0.0
GA-MEL	BE55	0.3	0.0	0.0
GA-MEL	BE60	0.2	0.0	0.0
GA-MEL	BE95	0.9	0.1	0.0
GA-MEL	C206	0.5	0.0	0.0
GA-MEL	C310	0.7	0.1	0.0
GA-MEL	C414	0.4	0.0	0.0
GA-MEL	C421	0.4	0.0	0.0
GA-MEL	PA34	0.4	0.0	0.0
GA-SEL	BE35	1.4	0.1	0.1
GA-SEL	BE36	0.9	0.1	0.0
GA-SEL	C172	2.9	0.2	0.1
GA-SEL	C182	0.8	0.1	0.0
GA-SEL	C210	0.8	0.1	0.0
GA-SEL	P28A	0.6	0.0	0.0
GA-SEL	SR22	0.6	0.1	0.0
GA-TP	AC90	1.1	0.1	0.0
GA-TP	B350	2.2	0.2	0.1
GA-TP	BE20	3.0	0.2	0.1
GA-TP	BE30	1.6	0.1	0.1
GA-TP	BE9L	1.2	0.1	0.1
GA-TP	C425	0.5	0.0	0.0
GA-TP	C441	0.4	0.0	0.0
GA-TP	D328	0.4	0.0	0.0
GA-TP	DHC6	2.1	0.2	0.1
GA-TP	P180	2.8	0.2	0.1
GA-TP	PAY2	0.3	0.0	0.0
GA-TP	PC12	2.6	0.2	0.1
Military	T33	0.1	0.0	0.0
Military	C130	0.0	0.0	0.0
Local	C152	7.0	0.6	0.3
Local	C172	5.7	0.5	0.3
Local	PA18	6.3	0.5	0.3
<b>Total</b>		<b>210.3</b>	<b>44.4</b>	<b>18.9</b>

Table 26 SJC 2035 Baseline Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-700/800/900	77.7	21.7	7.6
Airline-Psgr	A-318/319/320/321	57.8	16.1	5.6
Airline-Psgr	RJ-700	16.9	4.7	1.6
Airline-AC	DC10/MD11	0.3	0.1	0.0
Airline-AC	A300	0.1	0.0	0.0
Airline-AC	777	0.8	0.3	0.1
Airline-AC	A330	0.2	0.1	0.0
Airline-AC	767	1.1	0.5	0.1
Airline-AC	757	0.9	0.4	0.1
GA-BJ	GLF4	9.7	1.2	1.2
GA-BJ	LJ35	38.8	4.9	4.9
GA-MEL	BE58	2.1	0.2	0.1
GA-SEL	C172	8.2	0.7	0.4
GA-TP	C441	20.0	1.6	0.9
Military	T33	0.1	0.0	0.0
Military	C130	0.0	0.0	0.0
Local	C152	7.5	0.6	0.4
Local	C172	6.1	0.5	0.3
Local	PA18	6.7	0.5	0.3
<b>Total</b>		<b>254.9</b>	<b>54.0</b>	<b>23.6</b>

Note: The 2035 SJC Demand Management scenario is the same as the 2035 Baseline scenario.

**Table 27 SJC 2035 Redistribution Average Daily Landing & Takeoff Cycles**

<b>Category</b>	<b>Aircraft</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
Airline-Psgr	737-700/800/900	87.3	24.3	8.5
Airline-Psgr	A-318/319/320/321	64.0	17.9	6.3
Airline-Psgr	RJ-700	18.9	5.3	1.9
Airline-AC	DC10/MD11	0.3	0.1	0.0
Airline-AC	A300	0.1	0.0	0.0
Airline-AC	777	0.8	0.3	0.1
Airline-AC	A330	0.2	0.1	0.0
Airline-AC	767	1.1	0.5	0.1
Airline-AC	757	0.9	0.4	0.1
GA-BJ	GLF4	9.7	1.2	1.2
GA-BJ	LJ35	38.8	4.9	4.9
GA-MEL	BE58	2.1	0.2	0.1
GA-SEL	C172	8.2	0.7	0.4
GA-TP	C441	20.0	1.6	0.9
Military	T33	0.1	0.0	0.0
Military	C130	0.0	0.0	0.0
Local	C152	7.5	0.6	0.4
Local	C172	6.1	0.5	0.3
Local	PA18	6.7	0.5	0.3
<b>Total</b>		<b>272.8</b>	<b>59.0</b>	<b>25.4</b>

Table 28 SJC 2035 Internal Regional Airports Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-700/800/900	77.4	21.6	7.6
Airline-Psgr	A-318/319/320/321	57.6	16.1	5.6
Airline-Psgr	RJ-700	16.8	4.7	1.6
Airline-AC	DC10/MD11	0.3	0.1	0.0
Airline-AC	A300	0.1	0.0	0.0
Airline-AC	777	0.8	0.3	0.1
Airline-AC	A330	0.2	0.1	0.0
Airline-AC	767	1.1	0.5	0.1
Airline-AC	757	0.9	0.4	0.1
GA-BJ	GLF4	9.7	1.2	1.2
GA-BJ	LJ35	38.8	4.9	4.9
GA-MEL	BE58	2.1	0.2	0.1
GA-SEL	C172	8.2	0.7	0.4
GA-TP	C441	20.0	1.6	0.9
Military	T33	0.1	0.0	0.0
Military	C130	0.0	0.0	0.0
Local	C152	7.5	0.6	0.4
Local	C172	6.1	0.5	0.3
Local	PA18	6.7	0.5	0.3
<b>Total</b>		<b>254.4</b>	<b>53.8</b>	<b>23.6</b>

**Table 29 SJC 2035 External Regional Airports Average Daily Landing & Takeoff Cycles**

<b>Category</b>	<b>Aircraft</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
Airline-Psgr	737-700/800/900	73.7	20.6	7.2
Airline-Psgr	A-318/319/320/321	55.2	15.4	5.4
Airline-Psgr	RJ-700	16.0	4.5	1.6
Airline-AC	DC10/MD11	0.3	0.1	0.0
Airline-AC	A300	0.1	0.0	0.0
Airline-AC	777	0.8	0.3	0.1
Airline-AC	A330	0.2	0.1	0.0
Airline-AC	767	1.1	0.5	0.1
Airline-AC	757	0.9	0.4	0.1
GA-BJ	GLF4	9.7	1.2	1.2
GA-BJ	LJ35	38.8	4.9	4.9
GA-MEL	BE58	2.1	0.2	0.1
GA-SEL	C172	8.2	0.7	0.4
GA-TP	C441	20.0	1.6	0.9
Military	T33	0.1	0.0	0.0
Military	C130	0.0	0.0	0.0
Local	C152	7.5	0.6	0.4
Local	C172	6.1	0.5	0.3
Local	PA18	6.7	0.5	0.3
<b>Total</b>		<b>247.5</b>	<b>51.9</b>	<b>22.9</b>

Table 30 SJC 2035 Air Traffic Control Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-700/800/900	77.7	21.7	7.6
Airline-Psgr	A-318/319/320/321	57.8	16.1	5.6
Airline-Psgr	RJ-700	16.9	4.7	1.6
Airline-AC	DC10/MD11	0.3	0.1	0.0
Airline-AC	A300	0.1	0.0	0.0
Airline-AC	777	0.8	0.3	0.1
Airline-AC	A330	0.2	0.1	0.0
Airline-AC	767	1.1	0.5	0.1
Airline-AC	757	0.9	0.4	0.1
GA-BJ	GLF4	9.7	1.2	1.2
GA-BJ	LJ35	38.8	4.9	4.9
GA-MEL	BE58	2.1	0.2	0.1
GA-SEL	C172	8.2	0.7	0.4
GA-TP	C441	20.0	1.6	0.9
Military	T33	0.1	0.0	0.0
Military	C130	0.0	0.0	0.0
Local	C152	7.5	0.6	0.4
Local	C172	6.1	0.5	0.3
Local	PA18	6.7	0.5	0.3
<b>Total</b>		<b>254.9</b>	<b>54.0</b>	<b>23.6</b>

Table 31 SJC 2035 High Speed Rail Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
Airline-Psgr	737-700/800/900	64.2	17.9	6.3
Airline-Psgr	A-318/319/320/321	49.0	13.7	4.8
Airline-Psgr	RJ-700	16.9	4.7	1.6
Airline-AC	DC10/MD11	0.3	0.1	0.0
Airline-AC	A300	0.1	0.0	0.0
Airline-AC	777	0.8	0.3	0.1
Airline-AC	A330	0.2	0.1	0.0
Airline-AC	767	1.1	0.5	0.1
Airline-AC	757	0.9	0.4	0.1
GA-BJ	GLF4	9.7	1.2	1.2
GA-BJ	LJ35	38.8	4.9	4.9
GA-MEL	BE58	2.1	0.2	0.1
GA-SEL	C172	8.2	0.7	0.4
GA-TP	C441	20.0	1.6	0.9
Military	T33	0.1	0.0	0.0
Military	C130	0.0	0.0	0.0
Local	C152	7.5	0.6	0.4
Local	C172	6.1	0.5	0.3
Local	PA18	6.7	0.5	0.3
<b>Total</b>		<b>232.6</b>	<b>47.8</b>	<b>21.5</b>

Table 32 CCR 2007 Existing Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
	BEC190	1.4	0.1	0.1
	BEC58P	13.5	1.3	0.1
	BEC9F	0.7	0.0	0.1
	CIT3	2.0	0.1	0.0
	CL600	0.9	0.1	0.0
	CNA172	17.5	0.1	0.0
	CNA206	7.6	0.6	0.1
	CNA20T	21.6	1.6	0.3
	CNA441	1.9	0.1	0.1
	CNA500	0.4	0.0	0.0
	CNA55B	6.2	0.4	0.1
	CNA750	0.5	0.0	0.0
	DHC6	14.8	0.8	1.4
	DHC830	0.0	0.0	0.0
	DHC8	0.4	0.0	0.0
	FAL20	0.1	0.0	0.0
	GASEPF	13.6	0.0	0.0
	GASEPV	52.5	2.4	0.5
	GIIB	0.0	0.0	0.0
	GIV	0.9	0.1	0.0
	HS748A	0.2	0.0	0.0
	IA1125	1.2	0.1	0.0
	LEAR25	0.0	0.0	0.0
	LEAR35	2.1	0.1	0.0
	MU3001	0.4	0.0	0.0
	SABR80	1.0	0.0	0.0
	CRJ-700	0.0	0.0	0.0
<b>Total</b>		<b>161.4</b>	<b>8.1</b>	<b>169.5</b>

Table 33 CCR 2035 Baseline Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
	BEC190	1.4	0.1	0.1
	BEC58P	14.4	0.1	0.1
	BEC9F	0.8	0.1	0.1
	CIT3	2.1	0.0	0.0
	CL600	1.0	0.0	0.0
	CNA172	18.6	0.0	0.0
	CNA206	8.1	0.1	0.1
	CNA20T	22.9	0.4	0.4
	CNA441	2.0	0.1	0.1
	CNA500	0.4	0.0	0.0
	CNA55B	6.6	0.1	0.1
	CNA750	0.6	0.0	0.0
	DHC6	15.7	1.5	1.5
	DHC830	0.0	0.0	0.0
	DHC8	0.5	0.0	0.0
	FAL20	0.1	0.0	0.0
	GASEPF	14.4	0.0	0.0
	GASEPV	55.9	0.5	0.5
	GIIB	0.0	0.0	0.0
	GIV	0.9	0.0	0.0
	HS748A	0.2	0.0	0.0
	IA1125	1.3	0.0	0.0
	LEAR25	0.0	0.0	0.0
	LEAR35	2.2	0.0	0.0
	MU3001	0.5	0.0	0.0
	SABR80	1.1	0.0	0.0
	CRJ-700	0.0	0.0	0.0
	<b>Total</b>	<b>183.4</b>	<b>171.6</b>	<b>3.1</b>

Note: These operations are used for CCR for all 2035 scenarios with the exception of the Internal Regional Airports scenario.

Table 34 CCR 2035 Internal Regional Airports Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
	BEC190	1.4	0.1	0.1
	BEC58P	14.4	1.3	0.1
	BEC9F	0.8	0.0	0.1
	CIT3	2.1	0.1	0.0
	CL600	1.0	0.1	0.0
	CNA172	18.6	0.1	0.0
	CNA206	8.1	0.7	0.1
	CNA20T	22.9	1.7	0.4
	CNA441	2.0	0.2	0.1
	CNA500	0.4	0.0	0.0
	CNA55B	6.6	0.5	0.1
	CNA750	0.6	0.0	0.0
	DHC6	15.7	0.8	1.5
	DHC830	0.0	0.0	0.0
	DHC8	0.5	0.0	0.0
	FAL20	0.1	0.0	0.0
	GASEPF	14.4	0.0	0.0
	GASEPV	55.9	2.5	0.5
	GIIB	0.0	0.0	0.0
	GIV	0.9	0.1	0.0
	HS748A	0.2	0.0	0.0
	IA1125	1.3	0.1	0.0
	LEAR25	0.0	0.0	0.0
	LEAR35	2.2	0.1	0.0
	MU3001	0.5	0.0	0.0
	SABR80	1.1	0.0	0.0
	CRJ-700	27.5	1.4	0.5
<b>Total</b>		<b>199.2</b>	<b>10.0</b>	<b>3.6</b>

Table 35 STS 2007 Existing Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
	Q-400-Twin-engine prop	1.3	0.3	0.3
	Single-engine, Fixed	61.1	5.1	1.7
	Single-engine, Variable	41.0	3.4	1.1
	Twin-engine, Piston	22.3	1.9	0.6
	Twin-engine, Turboprop	5.1	0.4	0.1
	Piaggio Twin-engine prop	1.7	0.1	0.0
	Beech 400	5.0	0.4	0.1
	Gulfstream III	0.3	0.0	0.0
	Gulfstream IV	0.1	0.0	0.0
	Gulfstream V	0.1	0.0	0.0
	Falcon 50	0.1	0.0	0.0
	Falcon 900	0.3	0.0	0.0
	Hawker H25	0.6	0.0	0.0
	Cessna 550	5.0	0.4	0.1
	Cessna 650	1.0	0.1	0.0
	Cessna 750	2.0	0.2	0.1
	Challenger 600	0.2	0.0	0.0
	Lear 45	0.3	0.0	0.0
	Lear 60	0.3	0.0	0.0
	B206L	5.0	0.4	0.1
	A109	5.0	0.4	0.1
	A109 - Helicopter	0.6	0.0	0.0
	<b>Total</b>	<b>158.4</b>	<b>13.4</b>	<b>4.7</b>

Table 36 STS 2035 Baseline Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
	Boeing 737-700	2.0	0.2	0.1
	EMB-170-RJ	1.5	0.1	0.0
	EMB-190-RJ	1.9	0.2	0.1
	CRJ-700-RJ	1.5	0.1	0.0
	CRJ-900-RJ	1.6	0.1	0.0
	Q-400-Twin-engine prop	4.9	0.4	0.1
	Single-engine, Fixed	79.2	6.6	2.2
	Single-engine, Variable	51.5	4.3	1.4
	Twin-engine, Piston	29.2	2.4	0.8
	Twin-engine, Turboprop	7.1	0.6	0.2
	Piaggio-Twin-engine prop	3.7	0.3	0.1
	Beech 400	10.5	0.9	0.3
	Gulfstream III	0.3	0.0	0.0
	Gulfstream IV	0.3	0.0	0.0
	Gulfstream V	0.3	0.0	0.0
	Falcon 50	0.3	0.0	0.0
	Falcon 900	0.6	0.0	0.0
	Hawker H25	1.2	0.1	0.0
	Cessna 550	7.9	0.7	0.2
	Cessna 650	2.1	0.2	0.1
	Cessna 750	4.2	0.3	0.1
	Challenger 600	0.4	0.0	0.0
	Lear 45	0.6	0.0	0.0
	Lear60	0.6	0.0	0.0
	Very Light jets (VLJ)	15.7	1.3	0.4
	B206L	5.8	0.5	0.2
	A109	5.8	0.5	0.2
	A109	0.6	0.1	0.0
<b>Total</b>		<b>241.3</b>	<b>20.1</b>	<b>6.7</b>

Note: These operations are used for STS for all 2035 scenarios with the exception of the Internal Regional Airports scenario.

Table 37 STS 2035 Internal Regional Airports Average Daily Landing &amp; Takeoff Cycles

Category	Aircraft	Day	Evening	Night
	Boeing 737-700	2.0	0.2	0.1
	EMB-170-RJ	1.5	0.1	0.0
	EMB-190-RJ	1.9	0.2	0.1
	CRJ-700-RJ	14.4	1.2	0.4
	CRJ-900-RJ	1.6	0.1	0.0
	Q-400-Twin-engine prop	4.9	0.4	0.1
	Single-engine, Fixed	79.2	6.6	2.2
	Single-engine, Variable	51.5	4.3	1.4
	Twin-engine, Piston	29.2	2.4	0.8
	Twin-engine, Turboprop	7.1	0.6	0.2
	Piaggio-Twin-engine prop	3.7	0.3	0.1
	Beech 400	10.5	0.9	0.3
	Gulfstream III	0.3	0.0	0.0
	Gulfstream IV	0.3	0.0	0.0
	Gulfstream V	0.3	0.0	0.0
	Falcon 50	0.3	0.0	0.0
	Falcon 900	0.6	0.0	0.0
	Hawker H25	1.2	0.1	0.0
	Cessna 550	7.9	0.7	0.2
	Cessna 650	2.1	0.2	0.1
	Cessna 750	4.2	0.3	0.1
	Challenger 600	0.4	0.0	0.0
	Lear 45	0.6	0.0	0.0
	Lear60	0.6	0.0	0.0
	Very Light jets (VLJ)	15.7	1.3	0.4
	B206L	5.8	0.5	0.2
	A109	5.8	0.5	0.2
	A109	0.6	0.1	0.0
	<b>Total</b>	<b>254.1</b>	<b>21.2</b>	<b>7.1</b>

**Table 38 SUU 2007 Existing Average Daily Landing & Takeoff Cycles**

Category	Aircraft	Day	Evening	Night
	C-141A	0.9	0.0	0.0
	C-5A	24.4	6.1	3.7
	KC-10A	33.4	5.7	3.4
	KC-135R	5.7	0.9	0.2
	T-38A	0.9	0.0	0.0
	CRJ-700	0.0	0.0	0.0
<b>Total</b>		<b>65.2</b>	<b>12.6</b>	<b>7.3</b>

Note: These operations are also used for all SUU scenarios except 2035 Internal Regional Airports.

**Table 39 SUU 2035 Internal Regional Airports Average Daily Landing & Takeoff Cycles**

Category	Aircraft	Day	Evening	Night
	C-141A	0.9	0.0	0.0
	C-5A	24.4	6.1	3.7
	KC-10A	33.4	5.7	3.4
	KC-135R	5.7	0.9	0.2
	T-38A	0.9	0.0	0.0
	CRJ-700	26.0	2.2	0.7
<b>Total</b>		<b>91.1</b>	<b>14.8</b>	<b>8.0</b>

## Appendix B Aircraft Noise Terminology

To assist reviewers in interpreting the complex noise terminology used in evaluating airport noise, we present below an introduction to relevant fundamentals of acoustics and noise terminology.

### B.1 Introduction to Acoustics and Aircraft Noise Terminology

Five acoustical descriptors of noise are introduced here in increasing degree of complexity:

- Decibel, dB
- A-weighted decibel
- Maximum Sound Level, L<sub>max</sub>
- Time Above, TA
- Sound Exposure Level, SEL
- Equivalent Sound Level, Leq
- Community Noise Equivalent Level, CNEL

These descriptors form the basis for the majority of noise analysis conducted at most airports throughout California.

#### B.1.1 Decibel, dB

All sounds come from a sound source -- a musical instrument, a voice speaking, an airplane passing overhead. It takes energy to produce sound. The sound energy produced by any sound source is transmitted through the air in sound waves -- tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear.

Our ears are sensitive to a wide range of sound pressures. Although the loudest sounds that we hear without pain have about one million times more energy than the quietest sounds we hear, our ears are incapable of detecting small differences in these pressures. Thus, to better match how we hear this sound energy, we compress the total range of sound pressures to a more meaningful range by introducing the concept of sound pressure level.

Sound pressure levels are measured in decibels (or dB). Decibels are logarithmic quantities reflecting the ratio of the two pressures, the numerator being the pressure of the sound source of interest, and the denominator being a reference pressure (the quietest sound we can hear).

The logarithmic conversion of sound pressure to sound pressure *level* (SPL) means that the quietest sound that we can hear (the reference pressure) has a sound pressure level of about 0 dB, while the loudest sounds that we hear without pain have sound pressure levels of about 120 dB. Most sounds in our day-to-day environment have sound pressure levels on the order of 30 to 100 dB.

Because decibels are logarithmic quantities, combining decibels is unlike common arithmetic. For example, if two sound sources each produce 100 dB operating individually and they are then operated together, they produce 103 dB -- not the 200 decibels we might expect. Four equal sources operating simultaneously produce another three decibels of noise, resulting in a total sound pressure level of 106 dB. For every doubling of the number of equal sources, the sound pressure level goes up another three decibels. A tenfold increase in the number of sources makes the sound pressure level go up 10 dB. A hundredfold increase makes the level go up 20 dB, and it takes a thousand equal sources to increase the level 30 dB.

If one noise source is much louder than another, the two sources operating together will produce virtually the same sound pressure level (and sound to our ears) that the louder source would produce alone. For example, a 100 dB source plus an 80 dB source produce approximately 100 dB of noise when operating together (actually, 100.04 dB). The louder source "masks" the quieter one. But if the quieter source gets louder, it will have an increasing effect on the total sound pressure level such that, when the two sources are equal, as described above, they produce a level three decibels above the sound of either one by itself.

Conveniently, people also hear in a logarithmic fashion. Two useful rules of thumb to remember when comparing sound levels are: (1) a 6 to 10 dB increase in the sound pressure level is perceived by individuals as being a doubling of loudness, and (2) changes in sound pressure level of less than about three decibels are not readily detectable outside of a laboratory environment.

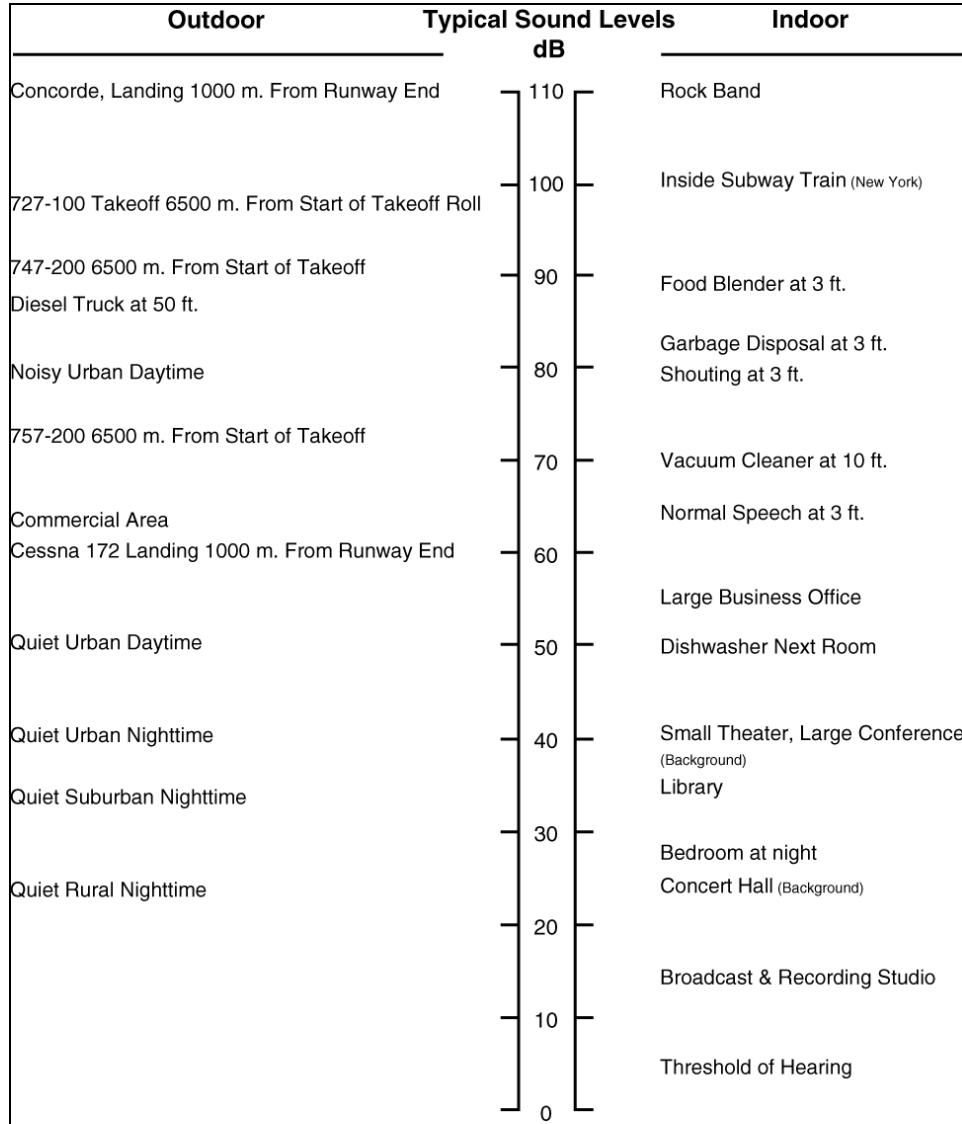
### **B.1.2 A-Weighted dB**

Another important characteristic of sound is its frequency, or "pitch." This is the rate of repetition of the sound pressure oscillations as they reach our ear. When analyzing the total noise of any source, acousticians often break the noise into frequency components (or bands) to determine how much is low-frequency noise, how much is middle-frequency noise, and how much is high-frequency noise. This breakdown is important for two reasons:

- People react differently to low-, mid-, and high-frequency noise levels. This is because our ear is better equipped to hear mid and high frequencies but is quite insensitive to lower frequencies. Thus, we find mid- and high-frequency noise to be more annoying.
- Engineering solutions to a noise problem are different for different frequency ranges. Low-frequency noise is generally harder to control.

The normal frequency range of hearing for most people extends from a low frequency of about 20 Hz to a high frequency of about 10,000 to 15,000 Hz. People respond to sound most readily when the predominant frequency is in the range of normal conversation, typically around 1,000 to 2,000 Hz. Psycho-acousticians have developed several filters which roughly match this sensitivity of our ear and thus help us to judge the relative loudness of various sounds made up of many different frequencies. The so-called A-weighting network does this best for most environmental noise sources. Sound pressure levels measured through this filter are referred to as A-weighted sound levels (measured in A-weighted decibels, or dBA).

The A-weighting network significantly discounts those parts of the total noise that occur at lower frequencies (those below about 500 Hz) and also at very high frequencies (above 10,000 Hz) where we do not hear as well. The network has very little effect, or is nearly "flat," in the middle range of frequencies between 500 and 10,000 Hz where our hearing is most sensitive. Because this network generally matches our ears' sensitivity, sounds having higher A-weighted sound levels are judged to be louder than those with lower A-weighted sound levels, a relationship which otherwise might not be true. It is for this reason that A-weighted sound levels are normally used to evaluate environmental noise sources. Figure 2 presents typical A-weighted sound levels of several common environmental sources.



**Figure 2 Common A-weighted environmental sound levels**

An additional dimension to environmental noise is that A-weighted levels vary with time. For example, the sound level increases as an aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance (though even the background varies as birds chirp, the wind blows, or a vehicle passes by). This is illustrated in Figure 3.

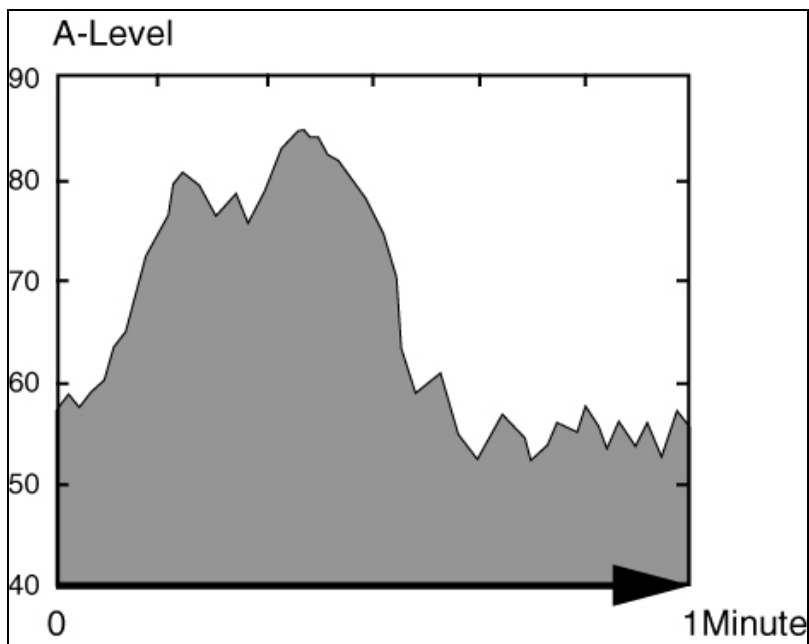


Figure 3 Variation of A-weighted sound level over time

### B.1.3 Maximum sound level, $L_{max}$ and Time Above, TA

Because of this variation, it is often convenient to describe a particular noise "event" by its maximum sound level, abbreviated as  $L_{max}$ . In Figure 3, the  $L_{max}$  is approximately 85 dBA. However, the maximum level describes only one dimension of an event; it provides no information on the cumulative noise exposure generated by a sound source. Two events with identical maximum levels may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be judged much more annoying. The following metrics, Time Above and Sound Exposure Level, account for event duration and total exposure, respectively.

### B.1.4 Time Above, TA

The Time Above is simply the amount of time that an event or set of events exceeds a given noise threshold. It is often notated as TA with a threshold value (e.g. TA 65 is the amount of time which the noise level exceeds 65 dBA). By matching a TA threshold to a particular noise effect (e.g. speech interference), the amount of time a noise effect occurs can be stated using the TA metric.

### B.1.5 Sound Exposure Level, SEL

The most common measure of cumulative noise exposure for a single aircraft fly-over is the Sound Exposure Level, or SEL. SEL is an accumulation of the sound energy over the duration of a noise event. The lightly shaded area in Figure 4 illustrates the portion of the sound energy included in this dose. To account for the variety of durations that occur among different noise events, the noise dose is normalized (standardized) to a one-second duration. This normalized dose is the SEL; it is shown as the darkly shaded area in Figure 4. Mathematically, the SEL is the summation of all the noise energy compressed into one second.

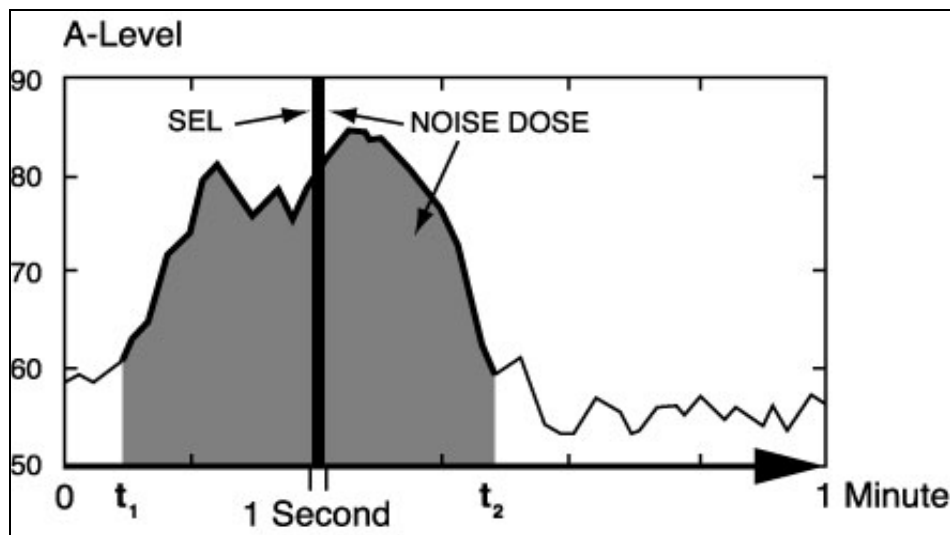


Figure 4 Graphic display of Sound Exposure Level, SEL

Note that because the SEL is normalized to one second, it will almost always be larger in magnitude than the maximum A-weighted level for the event. In fact, for most aircraft overflights, the SEL is on the order of 7 to 12 dBA higher than the  $L_{max}$ . Also, the fact that it is a cumulative measure means that not only do louder fly-overs have higher SEL than do quieter ones, but also fly-overs with longer durations have greater SEL than do shorter ones.

With this metric, we now have a basis for comparing noise events that generally matches our impression of the sound -- the higher the SEL, the more annoying it is likely to be. In addition, SEL provides a comprehensive way to describe a noise event for use in modeling noise exposure. Computer noise models base their computations on these SELs.

#### B.1.6 Equivalent Sound Level, $L_{eq}$

The Equivalent Sound Level, abbreviated  $L_{eq}$ , is a measure of the exposure resulting from the accumulation of A-weighted sound levels over a particular period of interest -- for example, an hour, an eight-hour school day, nighttime, or a full 24-hour day. However, because the length of the period can be different depending on the time frame of interest, the applicable period should always be identified or clearly understood when discussing the metric.

$L_{eq}$  may be thought of as a constant sound level over the period of interest that contains as much sound energy as the actual time-varying sound level. This is illustrated in Figure 5. The equivalent level is, in a sense, the total sound energy that occurred during the time in question, but spread evenly over the time period. It is a way of assigning a single number to a time-varying sound level. Since  $L_{eq}$  includes all sound energy, it is strongly influenced by the louder events.

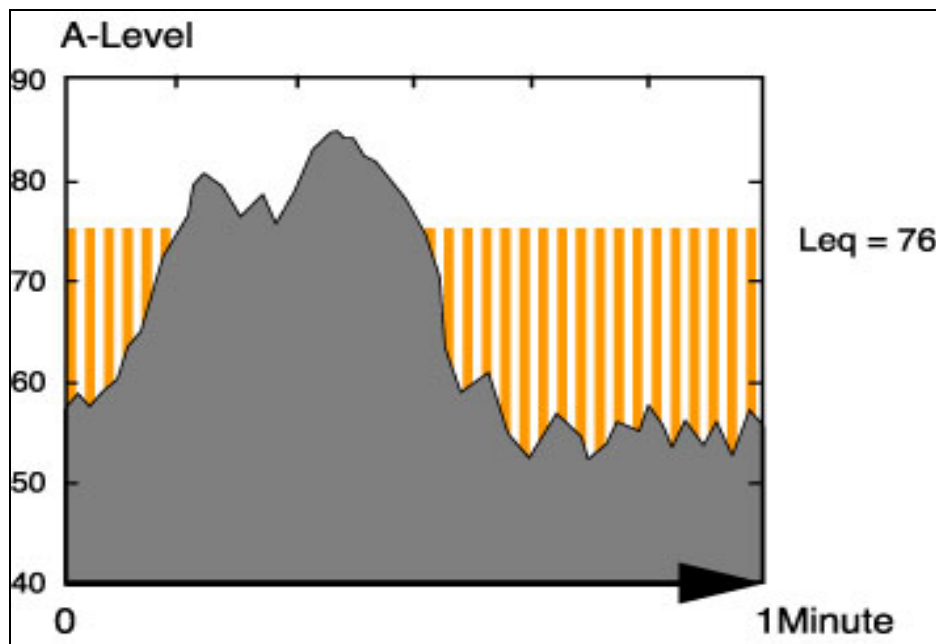


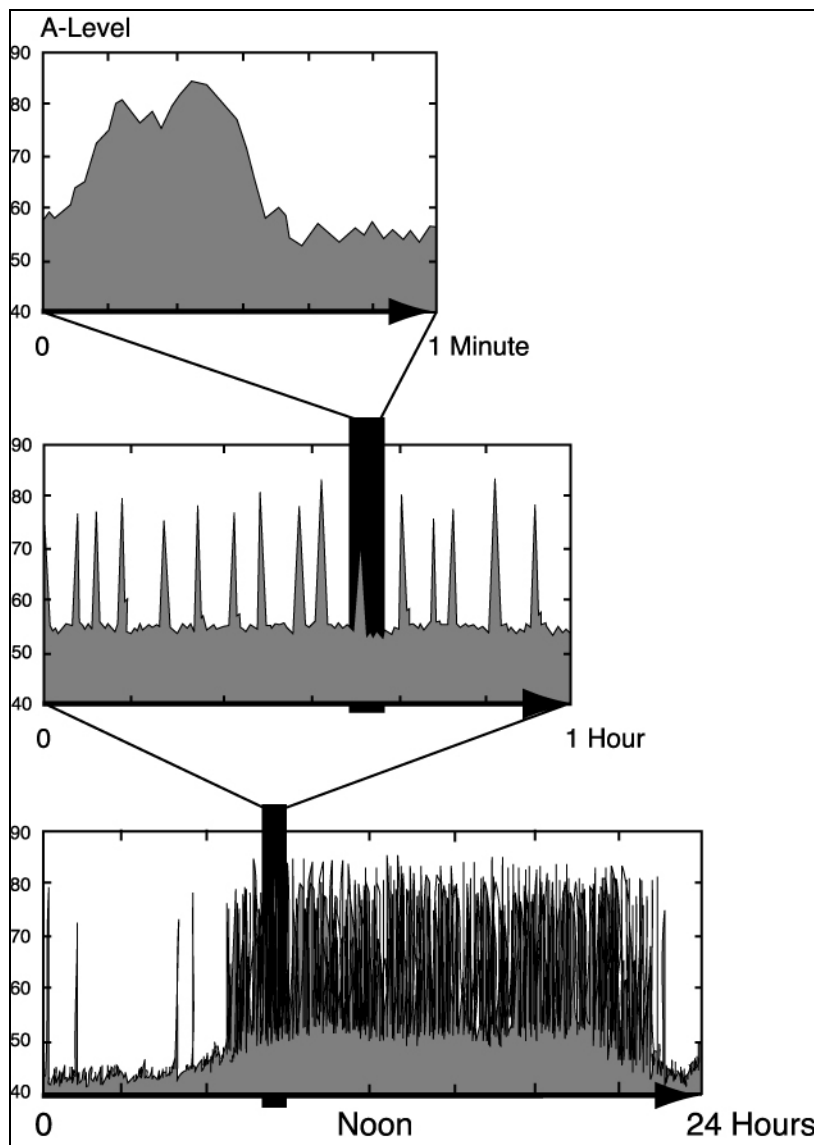
Figure 5 Graphical display of a one-minute Equivalent Sound Level,  $L_{eq}$

As for its application to airport noise issues,  $L_{eq}$  is often presented for consecutive one-hour periods to illustrate how the hourly noise dose rises and falls throughout a 24-hour period as well as how certain hours are significantly affected by a few loud aircraft.

### B.1.7 Community Noise Equivalent Level, CNEL

In the previous sections, we have been addressing noise measures that account for the moment-to-moment or short-term fluctuations in A-weighted levels as sound sources come and go affecting our overall noise environment. The Community Noise Equivalent Level (CNEL) represents a concept of noise dose as it occurs over a 24-hour period. It is the same as a 24-hour  $L_{eq}$ , with one important exception; CNEL treats evening and nighttime noise differently from daytime noise. In determining CNEL, it is assumed that the A-weighted levels occurring at night (10 p.m. to 7 a.m.) are 10 dB louder than they really are. This 10 dB penalty is applied to account for greater sensitivity to nighttime noise, and the fact that events at night are often perceived to be more intrusive because nighttime ambient noise is less than daytime ambient noise. A lesser penalty is applied to evening noise levels (7 p.m. to 10 p.m.). The evening penalty is approximately 4.77 dB and likewise accounts for the greater sensitivity to noise in the evening.

Earlier, we illustrated the A-weighted level due to an aircraft event. The example is repeated in the top frame of Figure 6. The level increases as the aircraft approaches, reaching a maximum of 85 dBA, and then decreases as the aircraft passes by. The ambient A-weighted level around 55 dBA is due to the background sounds that dominate after the aircraft passes. The shaded area reflects the noise dose that a listener receives during the one-minute period of the sample.



**Figure 6 Sound level fluctuation and noise dose**

The center frame of Figure 6 includes this one-minute interval within a full hour. Now the shaded area represents the noise dose during that hour when sixteen aircraft pass nearby, each producing a single event dose represented by an SEL. Similarly, the bottom frame includes the one-hour interval within a full 24 hours. Here the shaded area represents the noise dose over a complete day. Note that several overflights occur at night, when the background noise drops some 10 decibels, to approximately 45 dBA.

Values of CNEL are normally measured with standard monitoring equipment or are predicted with computer models. Measurements are practical for obtaining CNEL values for only relatively limited numbers of locations, and, in the absence of a permanently installed monitoring system, only for relatively short time periods. Thus, most airport noise studies utilize computer-generated estimates of CNEL, determined by accounting for all of the SEL from individual aircraft operations that comprise the total noise dose at a given location on the ground. This principle is used in all airport noise modeling.

Computed values of CNEL are usually depicted as noise contours that are lines of equal exposure around an airport (much as topographic maps have contour lines of equal elevation). The contours usually reflect long-term (annual average) operating conditions, taking into account the average flights per day, how often each runway is used throughout the year, and where over the surrounding communities the aircraft normally fly.