Runway 6L-24R and Runway 6R-24L Runway Safety Area and Associated Improvements Draft EIR

Appendix F

Noise

1.0 INTRODUCTION

Sound, when transmitted through the air and upon reaching our ears, may be perceived as desirable or unwanted. People normally refer to noise as unwanted sound. Because sound can be subjective, individuals have different perceptions, sensitivities, and reactions to noise. Loud sounds may bother some people, while others may be bothered by certain rhythms or frequencies of sound. Sounds that occur during sleeping hours are usually considered to be more objectionable than those that occur during daytime hours.

Noise levels are measured using a variety of scientific metrics. As a result of extensive research into the characteristics of aircraft noise and human response to that noise, standard noise descriptors have been developed for aircraft noise exposure analyses. The descriptors used in this noise analysis are described below.

Decibel, dB: Sound is a complex physical phenomenon consisting of complex minute vibrations traveling through a medium, such as air. These vibrations are sensed by the human ear as sound pressure. Because of the vast range of sound pressure or intensity detectable by the human ear, sound pressure level (SPL) is represented on a logarithmic scale known as decibels (dB). A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet (laboratory-type) listening conditions. An SPL of 120 dB begins to be felt inside the ear, and discomfort and pain at approximately 140 dB. Most environmental sounds have SPLs ranging from 30 to 100 dB.

Because decibels are logarithmic, they cannot be added or subtracted directly like other (linear) numbers. For example, if two sound sources each produce 100 dB, when they are operated together they will produce 103 dB, not 200 dB. Four 100 dB sources operating together again double the sound energy, resulting in a total SPL of 106 dB, and so on. In addition, if one source is much louder than another, the two sources operating together will produce the same SPL as if the louder source were operating alone. For example, a 100 dB source plus an 80 dB source produce 100 dB when operating together. Two useful rules to remember when comparing SPLs are: (1) most people perceive a 6 to 10 dB increase in SPL between two noise events to be about a doubling of loudness, and (2) changes in SPL of less than about 3 dB between two events are not easily detected outside of a laboratory.

A-Weighted Sound Pressure Level, dBA: The decibel (dB) is a unit for describing sound pressure level. When expressed in dBA, the sound has been filtered to reduce the effect of very low and very high frequency sounds, much like the human ear does. Frequency, or pitch, is a basic physical characteristic of sound and is expressed in units of cycles per second or hertz (Hz). The normal frequency range of hearing for most people extends from about 20 to 20,000 Hz. Because the human ear is more sensitive to middle and high frequencies (i.e., 1,000 to 4,000 Hz), as compared to low frequencies, a frequency weighting called "A" weighting is applied. With the A-weighting, calculations and sound monitoring equipment approximates the sensitivity of the human ear to sounds of different frequencies.

Some common sounds on the dBA scale are listed in **Table 1**. As shown in the table, the relative perceived loudness of a sound doubles for each increase of 10 dBA, even though a 10 dBA change corresponds to a change of relative sound energy by a factor of 10. Generally, sounds with differences of 2 dBA or less are not perceived to be noticeably different by most listeners.

Table 1

Common Sounds On The A-Weighted Decibel Scale

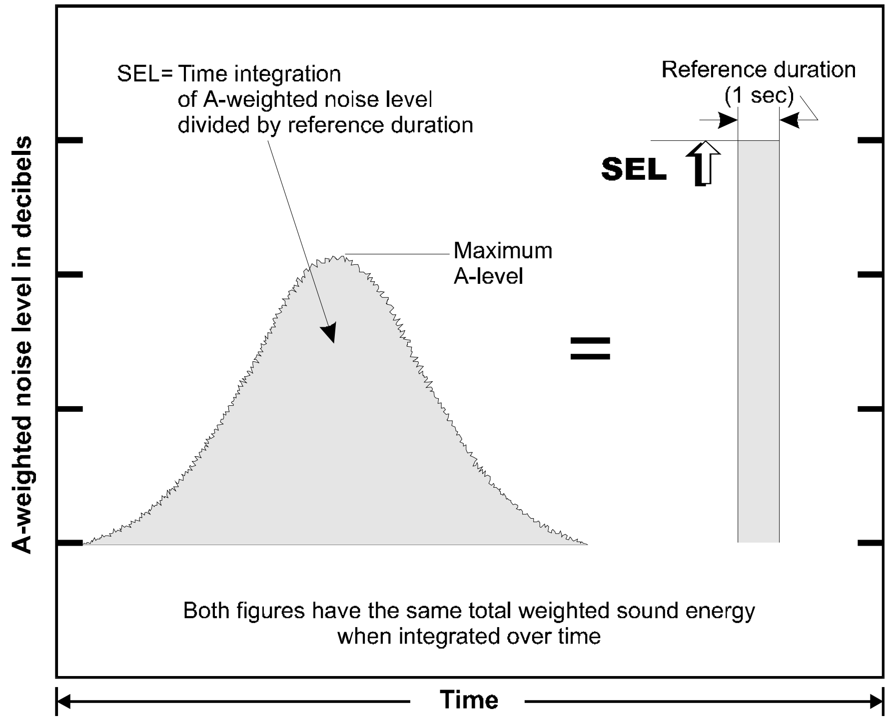
Sound	Sound Level (dBA)	Relative Loudness (approximate)	Relative Sound Energy
Rock Music, with amplifier	120	64	1,000,000
Thunder, snowmobile (operator)	110	32	100,000
Boiler shop, power mower	100	16	10,000
Orchestral crescendo at 25 feet, noisy kitchen	90	8	1,000
Busy Street	80	4	100
Interior of department store	70	2	10
Ordinary conversation, 3 feet away	60	1	1
Quiet automobiles at low speed	50	½	0.1
Average office	40	1/4	0.01
City residence	30	1/8	0.001
Quite country residence	20	1/16	0.0001
Rustle of leaves	10	1/32	0.00001
Threshold of hearing	0	1/64	0.000001

Source: U.S. Department of Housing and Urban Development, Aircraft Noise Impact--Planning Guidelines for Local Agencies, 1972

Maximum A-Weighted Noise Level, L_{max}: Sound levels vary with time. For example, the sound increases as an aircraft approaches, then falls and blends into the ambient or background as the aircraft recedes into the distance. Because of this variation, it is often convenient to describe a particular noise "event" by its highest or maximum sound level (L_{max}). Note that L_{max} describes only one dimension of an event; it provides no information on the cumulative noise exposure generated by a sound source. In fact, two events with identical L_{max} may produce very different total exposures as one may be of very short duration, while the other may be much longer.

Sound Exposure Level, SEL: Sound exposure level (SEL) is a time integrated measure, expressed in decibels, of the sound energy of a single noise event to a reference duration of one second. The sound level is integrated over the period that the level exceeds a threshold. Therefore, SEL accounts for both the maximum sound level and the duration of the sound. The standardization of discrete noise events into a one-second duration allows the calculation of the cumulative noise exposure of a series of noise events that occur over a period of time. Because of this compression of sound energy, the SEL of an aircraft noise event is typically 7 to 12 dBA greater than the L_{max} of the event. SEL values for aircraft noise events depend on the location of the aircraft relative to the noise receptor, the type of operation (landing, takeoff, or overflight), and the type of aircraft. The SEL concept is depicted on **Exhibit 1**.

Exhibit 1



Equivalent Continuous Noise Level (L_{eq}): L_{eq} is the sound level, expressed in dBA, of a steady sound which has the same A-weighted sound energy as the time-varying sound over the averaging period. Unlike SEL, L_{eq} is the average sound level for a specified time period (e.g., 24 hours, 8 hours, 1 hour, etc.). L_{eq} is calculated by integrating the sound energy from all noise events over a given time period and applying a factor for the number of events. L_{eq} can be expressed for any time interval, for example the L_{eq} representing an averaged level over an 8-hour period would be expressed as $L_{eq(8)}$.

A-weighted Day-Night Average Sound Level, DNL: DNL, also denoted as Ldn is expressed in dBA and represents the noise level over a 24-hour period. DNL includes the cumulative effects of a number of sound events rather than a single event. It also accounts for increased sensitivity to noise during nighttime hours. The DNL values are used to estimate the effects of specific noise levels on land uses. The U.S. Environmental Protection Agency (USEPA) introduced the metric in 1976 as a single number measurement of community noise exposure. The FAA adopted DNL as the noise metric for measuring cumulative aircraft noise under FAR Part 150, *Airport Noise Compatibility Planning*. The Department of Housing and Urban Development, the Veterans Administration, the Department of Defense, the United States Coast Guard, and the Federal Transit Administration have also adopted DNL for measuring cumulative noise exposure.

The calculation of DNL applies a 10-decibel-weighting penalty (equivalent to a tenfold increase in aircraft operations) for each hour during the night-time period (10:00 p.m. to 7:00 a.m.) before the 24-hour value is computed. The weighting penalty accounts for the more intrusive nature of noise during the nighttime hours.

DNL is expressed as an average noise level on the basis of annual aircraft operations for a calendar year, not on the average noise levels associated with different aircraft operations. To calculate the DNL at a specific location, SEL values at that location associated with each individual aircraft operation (landing or takeoff) are determined. Using the SEL for each noise event and applying the 10-decibel penalty for nighttime operations as appropriate, a partial DNL value is then calculated for each aircraft operation. The partial DNL values for each aircraft operation are added logarithmically to determine the total DNL.

The logarithmic addition process, whereby the partial DNL values are combined, can be approximated by the following guidelines:

When two DNLs differ by:	Add the following amount to the higher value:
0 or 1 dBA	3 dBA
2 or 3 dBA	2 dBA
4 to 9 dBA	1 dBA
10 dBA or more	0 dBA

For example:

70 dBA + 70 dBA (difference: 0 dBA) = 73 dBA
60 dBA + 70 dBA (difference: 10 dBA) = 70 dBA

Adding the noise from a relatively quiet event (60 dBA) to a relatively noisy event (70 dBA) results in a value of 70 dBA because the quieter event has only 1/10 of the sound energy of the noisier event. As a result, the quieter noise event is “drowned out” by the noisier one, and there is no increase in the overall noise level as perceived by the human ear.

DNL is used to describe existing and predicted noise exposure in communities in an airport environs based on the average daily operations over the year and the average annual operational conditions at the airport. Therefore, at a specific location near an airport, the noise exposure on a particular day is likely to be higher or lower than the annual average exposure, depending on the specific operations at the airport on that day. DNL has been widely accepted as the best available method to describe aircraft noise exposure and is the noise descriptor required by FAA for aircraft noise exposure analyses and land use compatibility planning under Federal Aviation Regulations Part 150, *Airport Noise Compatibility Planning*, and for environmental assessments for airport improvement projects.

Community Noise Equivalent Level, CNEL: California law mandates use of the Community Noise Equivalent Level (CNEL) for assessing airport noise exposure.[1] As stated above, for aviation noise analysis, the FAA has determined that the cumulative noise exposure of individuals resulting from aircraft noise must be established in terms of the yearly day-night average sound level (DNL) metric, but accepts the use of the CNEL for aircraft noise evaluations in California.[2]

1 California Code of Regulations, Title 21, Division 2.5, Chapter 6.

2 The FAA definition of "significance" is specified using the day-night average sound level (DNL) metric. The FAA recognizes the use of the Community Noise Equivalent Level (CNEL) for aircraft noise evaluations in California.

CNEL is a 24-hour, time-weighted average noise metric, expressed in terms of dBA, which accounts for the noise levels of individual aircraft events, the number of times those events occur, and the time of day they occur. CNEL is calculated based on noise levels and operational activity occurring during three time periods: daytime (7:00 a.m. to 6:59 p.m.), evening (7:00 p.m. to 9:59 p.m.), and nighttime (10:00 p.m. to 6:59 a.m.). To represent the added intrusiveness of sounds during evening and nighttime hours, CNEL adds weights of 4.77 dBA and 10 dBA to events occurring during the evening and nighttime periods, respectively.[3]

1.1.1 CNEL and Noise Exposure Ranges

Noise exposure criterion levels of CNEL 65 dB, 70 dB, and 75 dB were used for the analysis, in accordance with FAA Order 1050.1E. The three noise exposure ranges used were 1) CNEL 65 to 70 dB, 2) CNEL 70 to 75 dB, and 3) CNEL 75+ dB. Noise exposure maps for 2012 existing conditions and for 2015 future conditions for both the With Project and Without Project conditions were prepared. The CNEL 65 dB contour was examined for each of the alternatives to identify noise sensitive areas where noise would increase by CNEL 1.5 dB or greater, when compared to the CNEL 65 dB contour for the normal operations in the same timeframe. A

1.1.2 Graphic Representation

To graphically represent DNL, contour lines that connect points of equal DNL values are drawn on a map. For example, a contour may be drawn to connect all points with a DNL of 70 dB; another may be drawn to connect all points with a DNL of 65 dB; and so forth. Aircraft noise exposure contours were drawn at 5 DNL intervals to reflect the ranges in DNL values from 65 to 75 dB. In addition, a CNEL 65 dB contour was prepared for the runway closure period of the construction phase, for comparison to the CNEL 65 dB contour for the Without Project in the same timeframe.

1.1.3 The CNEL Descriptor

The validity and accuracy of CNEL calculations depend on the basic information used in the calculations. For future airport activities, the reliability of CNEL calculations is affected by a number of uncertainties:

- Future aviation activity levels—the forecast number of aircraft operations, the types of aircraft serving the airport, the times of operation (daytime, evening, and nighttime), and aircraft flight tracks—are estimates. Achievement of the estimated levels of activity cannot be assured.

See FAA Order 1050.1E, Appendix A, Section 14 for FAA's acceptance of CNEL as a suitable substitute for DNL.

3 State of California, Department of Transportation, Division of Aeronautics, *California Airport Land Use Planning Handbook,* 2002.

- Acoustical and performance characteristics of future aircraft are also estimates. When new aircraft designs are involved, aircraft noise data and flight characteristics must be estimated.
- The noise descriptors used as the basis for calculating CNEL represent typical human response (and reaction) to aircraft noise. Because people vary in their responses to noise and because the physical measure of noise accounts for only a portion of an individual's reaction to that noise, CNEL can be used only to obtain an average response to aircraft noise that might be expected from a community.
- Single flight tracks used in computer modeling represent a wider band of actual flight tracks.

These uncertainties aside, CNEL mapping was developed as a tool to assist in land use planning around airports. The mapping is best used for comparative purposes rather than for providing absolute values. That is, CNEL calculations provide valid comparisons between different projected conditions, as long as consistent assumptions and basic data are used for all calculations.

Thus, sets of CNEL calculations can show anticipated changes in aircraft noise exposure over time, or differences in noise exposure associated with different airport development alternatives or operational procedures. However, a line drawn on a map does not imply that a particular noise condition exists on one side of that line and not on the other. CNEL calculations provide a means for comparing noise exposure under different scenarios.

Nevertheless, CNEL contours can be used to (1) highlight an existing or potential aircraft noise problem that requires attention, (2) assist in the preparation of noise compatibility programs, and (3) provide guidance in the development of land use controls, such as zoning ordinances, subdivision regulations, and building codes. CNEL is considered to be the best noise metric available for expressing aircraft noise exposure.

1.1.4 Evaluation Of The Adequacy of the DNL Descriptor

In order to address concerns related to methods of aircraft noise measurement, and to reach a national consensus, the Federal Interagency Committee on Noise (FICON) was created to assess the manner in which noise exposure and its effects are evaluated and the usefulness of DNL to describe the effects of aircraft noise on people. The committee included representatives of all of the federal agencies involved in environmental noise studies, including staff from the USEPA, the Council on Environmental Quality (CEQ), the Departments of Treasury, Defense (DOD), Housing and Urban Development (HUD), Veterans Affairs, and Transportation, as well as technical advisors from the Committee on Hearing and Biomechanics.

The FICON evaluated the threshold for acceptable noise levels (threshold of significance) and whether the DNL 65 was the proper threshold. The committee's findings were released in the Federal Register (FR 44223, September 24, 1992). Some of the committee's conclusions were:

- Continue using the DNL to measure airport noise;
- Complaints are an inadequate indicator of the full extent of noise effects on a population;

- Noise predictions and interpretations are frequently less reliable below DNL 65—predictions below this level should take into account the inaccuracy of prediction models at large distances from the airport;
- No definitive evidence of non-auditory health effects from aircraft noise exist, particularly below DNL 70;
- Every change in the noise environment does not necessarily affect public health and welfare.

FICON also recommended that a new federal interagency committee be formed with a mandate to provide a forum for debate of future aviation noise research needs.

In March 1993, the FAA requested public comments concerning the FICON report released in 1992.[4] The request for comment coincided with a study that was prepared by the FAA in accordance with the *Safety, Capacity, Noise Improvement, and Intermodal Transportation Act of 1992*.[5] Later in 1993 the Federal Interagency Committee on Aviation Noise (FICAN) was formed. FICAN has provided a forum for soliciting input from interested members of the aviation profession and communities. FICAN members have worked with researchers to develop individual agency priorities for research to address noise issues, and have published technical papers on aviation noise topics, including a 1997 study of the effects of aviation noise on sleep.[6] One of the findings of FICAN was that the use of supplemental metrics provides valuable information that is not easily captured by DNL. However, both FICON and FICAN validated the use of the DNL metric as the acceptable metric to identify significant aircraft noise impacts.

2.0 AIRCRAFT NOISE

Aircraft noise originates from both the engines and the airframe of an aircraft, but the engines are by far the more significant source of noise. Meteorological conditions affect the propagation (or transmission) of sound through the air. Wind speed and direction, and the temperature immediately above ground level cause diffraction and displacement of sound waves. Humidity and temperature materially affect propagation of air-to-ground sound through absorption associated with the instability and viscosity of the air.

2.1 Noise Analysis Methodology

The methodology used for this aircraft noise analysis involved: (1) the use of noise descriptors developed for airport noise analyses; (2) development of basic data and assumptions for use as

4 *Federal Register*, FR16569, March 29, 1993.

5 Section 123 of the *Airport and Airway Safety, Capacity, Noise Improvement, and Intermodal Transportation Act of 1992* (49 U.S.C. app 2102, PL 102-581) required the FAA to conduct a noise study and report the results to Congress not later than October 31, 1993. The study analyzed the social, economic, and health effects of airport noise within the DNL 55, 60, and 65 dBA contours to determine the actual level at which noise adversely impacts populations. It also included an evaluation of single event analysis on populations.

6 *Effects of Aviation Noise on Awakenings from Sleep*, Federal Interagency Committee on Aviation Noise, June 1997.

input to a computer model; and (3) the application of the computer model, providing estimates of aircraft noise levels.

2.2 Integrated Noise Model

In 1978, the FAA released the first version of a computer simulation model designed to assess aircraft noise exposure. Known as the Integrated Noise Model or INM, it has become the standard tool used for modeling airport noise. The INM generates noise exposure contours and noise levels at individual locations and provides a graphical image of aircraft noise levels for a selected geographic area.

The INM computes DNL using an internal database that includes performance characteristics and noise data for a wide variety of civilian and military aircraft. Noise exposure levels are calculated from airport-specific data that are input into the model. The input includes runway coordinates, flight tracks, fleet mix, activity levels, runway and flight track utilization, average local temperatures, time of day, and departure trip length data. The INM correlates these data with the internal aircraft database using a series of algorithms that calculate noise exposure. The INM database incorporates detailed information about each aircraft type, including departure profiles for different trip lengths, approach profiles, and SEL noise curves based on distances and various thrust settings. The outputs of these calculations include plots of points that connect to form noise contours. The INM is typically used to model average annual aircraft noise exposure, that is, the average sound level over an average 24-hour period of both busy and quiet times for the airport.

Other output from the INM include the area within each contour, noise measurements at locations (referred to as grid points), and SEL curves or values for specific aircraft types. The SEL curves can be used to estimate SEL for a specific aircraft type depending on how far the aircraft is from a listening point or observer and the estimated thrust setting. Since the introduction of the INM, newer versions have been released by the FAA with an updated aircraft database to reflect changes in the existing and projected aircraft fleet mixes of airports throughout the National Airspace System and to incorporate enhanced algorithms for calculating aircraft noise at specific locations and propagation of noise.

Version 7.0d of INM was used for the noise analysis documented in this EIR, which was the latest approved version of the model at the time the analysis was done. Version 7.0d is an accepted, state-of-the-art tool for determining the total effect of aircraft noise at and around airports. The aircraft database contains a representation of commercial, general aviation, and military aircraft powered by turbojet, turbofan, turboprop, or piston-driven engines.

Noise exposure maps were generated using INM for existing and future conditions using a slightly different aircraft fleet mix and runway usage for the years included in the study (2012 and 2015). Three scenarios were modeled in INM: 1) existing 2012; 2) 2015 Without Project (2015 With Project is the same as 2015 Without Project); and 3) annualized 2015 temporary runway closure and displaced threshold period. During the construction phase of the proposed Project, there would be a short-term (estimated 6 months) increase in aircraft noise exposure over some areas east of Runway 6R-24L due to aircraft operations being shifted from this runway during the 4-month runway closure period and the 2-month period that Runway 6L-24R would operate with a displaced threshold of 1,925 feet. As the INM model produces noise contours representing average annual noise exposure, the 4-month runway closure period and 2-month period with a reduced runway length on Runway 6L-24R had to be annualized with 6 months of normal operations to establish annual noise exposure. The noise exposure maps derived from the INM for this study are based on the DNL noise metric.

2.3 Basic Data and Assumptions

To determine aircraft noise exposure levels under existing and forecasted conditions, aircraft operations attributed to an average annual day are used in INM. For this EIR, noise exposure was analyzed for operational years 2012 (existing conditions) and 2015. Additionally, noise exposure during the temporary closure of Runway 6L-24R and the 2-month reduced runway length during the construction phase was analyzed.

The primary data required to develop noise exposure maps using INM Version 7.0d includes:

- The existing and forecasted number of aircraft operations accounted for by time of day, type of aircraft, and stage length (nonstop departure trip length from LAX).
- Operational information including runway use, location and use of flight tracks (the paths that pilots fly to arrive at and depart from an airport), departure profiles, existing noise abatement procedures, etc.

2.3.1 Aircraft Operations

Individual daily aircraft operations information at LAX for 2012 were obtained from LAWA. Individual daily aircraft operations for 2015 were calculated based on the Specific Plan Amendment Study (SPAS) Passenger forecast. Annual flight operations data for 2015 are shown in **Table 2**. Operations data between the 2015 Without Project and 2015 Runway Closure period are the same.

Table 2

Existing and Forecast LAX Aircraft Flight Operations

Aircraft Category	2012 Aircraft Operations	2015 Aircraft Operations
Air Carrier (AC)	481,338	509,967
Air Taxi (AT)	103,159	87,209
General Aviation (GA)	18,334	19,130
Military (MIL)	2,649	2,672
Total Operations	**605,480**	**618,978**

Note: The 2015 annual operations were extrapolated based on the numbers of forecasted passengers identified in the SPAS Passenger Forecast, a peak month-to-year ratio for July 2012 and the resulting numbers of peak month average day operations for each year between 2009 and 2025.

Source: Ricondo & Associates, Inc., January 2014.

2.3.2 Aircraft Fleet Mix

Aircraft noise levels can vary greatly based on the aircraft type. This is due to differences in the noise emissions of the various airframe/engine combinations and aircraft performance characteristics. For this reason, it is very important to determine the precise mix of aircraft operating from the airport. The Design Day Flight Schedule (DDFS) was used to determine the 2015 fleet mix. The fleet mix for 2015 is the same between the Without Project and Runway Closure period scenarios.

Table 3 presents the different INM aircraft types modeled for LAX. For noise modeling purposes, aircraft are assigned an aircraft type from the INM database. While INM aircraft types provide representative noise characteristics for a large variety of aircraft, the database is not exhaustive. When selecting INM aircraft type, it is often appropriate to combine aircraft with similar characteristics (e.g., engine types, number of engines, weight, performance characteristics, and noise exposure characteristics) under the same INM aircraft type.

Table 3

LAX 2012 and 2015 Fleet Mix

INM Designation	2012 Annual Operations	2015 Annual Operations
7478	-	2,356
737300	30,349	17,723
737400	4,384	6,817
737500	2,698	-
737700	82,282	89,294
737800	37,093	61,346
747400	12,794	12,248
757300	14,495	10,561
767300	19,887	25,208
777200	16,827	12,588
777300	10,099	13,603
1900D	2,333	6,135
74720B	674	681
757PW	40,115	38,838
757RR	15,506	21,463
7878R	673	1,701
A300-622R	2,697	1,363
A300B4-203	-	1,362
A310-304	-	681
A319-131	21,246	29,310
A320-211	45,861	20,107
A320-232	16,861	39,875
A321-232	10,787	10,220
A330-301	2,022	3,406
A330-343	1,348	-
A340-211	2,691	3,400
A340-642	2,692	2,720

Table 3

LAX 2012 and 2015 Fleet Mix

INM Designation	2012 Annual Operations	2015 Annual Operations
A380-841	3,297	4,712
C130E	776	680
CL600	3,886	3,407
CL601	21,759	43,609
CNA441	3,847	-
CNA750	1,476	1,363
CRJ9-ER	58,652	62,006
DC1010	2,023	2,040
DC870	-	681
DHC6	1,477	1,363
DHC830	6,997	6,817
EMB120	38,483	33,401
EMB145	31,551	1,363
EMB190	-	3,407
EMB19C	5,056	-
GIIB	777	681
GIV	2,332	2,044
GV	1,554	1,363
LEAR35	4,663	4,089
MD11GE	2,693	2,722
MD81	3,372	3,067
MD82	6,070	-
MD83	6,070	5,112
MU3001	2,254	2,044

Source: Ricondo & Associates, Inc., January 2014.

2.3.3 Time of Day

The Time of Day aircraft operations occur is important for determining cumulative noise exposure. In the CNEL metric, aircraft noise levels are weighted based on the time of day they occur. In determining CNEL, each aircraft operation occurring during the nighttime, between the hours of 10:00 p.m. and 7:00 a.m., is treated as if it were 10 operations in terms of noise exposure. Similarly, operations taking place during the evening period, between the hours of 7:00 and 10:00 p.m., are treated as if they were three operations. Logarithmically, these multipliers are the equivalent of adding 10 dB to the noise level of each nighttime operation and 4.77 dB to the noise level of each evening operation. These noise level penalties are intended to correspond to the drop in background noise level which studies have found takes place naturally from daytime to evening and nighttime in a typical community. The evening and nighttime decrease in ambient sound levels—from both outdoor and indoor sources—is commonly considered to be the principal explanation for people's heightened sensitivity to noises during these periods. CNEL is designed to account for this increased sensitivity. **Tables 4** and **5** summarize the operations by time of day for 2012 and 2015, respectively. Time of day operations by aircraft category do not differ between the Without Project and Runway Closure scenarios.

Table 4

Summary of Operations by Time of Day (2012)

	Annual Flight Operations		
Aircraft Category	**Day (7 a.m. – 7 p.m.)**	**Evening (7 p.m. – 10 p.m.)**	**Night (10 p.m. – 7 a.m.)**
Large Narrow-Body	10.9%	11.2%	17.8%
Large Wide-Body and New Large Aircraft	8.5%	8.9%	17.4%
Non-Jet	9.8%	8.5%	5.3%
Small Jet	24.2%	24.9%	13.3%
Small Narrow-Body	41.9%	41.9%	37.5%
Small Wide-Body	4.7%	4.6%	8.7%

Source: Ricondo & Associates, Inc., 2014.

Table 5

Summary of Operations by Time of Day (2015)

	Annual Flight Operations		
Aircraft Category	**Day (7 a.m. – 7 p.m.)**	**Evening (7 p.m. – 10 p.m.)**	**Night (10 p.m. – 7 a.m.)**
Large Narrow-Body	12.2%	14.4%	18.8%
Large Wide-Body and New Large Aircraft	9.1%	8.8%	12.3%
Non-Jet	8.8%	5.3%	5.7%
Small Jet	21.3%	21.6%	12.2%
Small Narrow-Body	44.3%	46.0%	41.5%
Small Wide-Body	4.3%	3.9%	9.5%

Source: Ricondo & Associates, Inc., 2014.

2.3.4 Runway Use

Runway utilization refers to the percentage of operations that utilize a given runway. Aircraft generally take off and land into the wind. As a result, runway utilization is largely determined by prevailing wind conditions. At LAX, prevailing winds are westerly. For operational efficiency, aircraft departures generally occur from the inboard runways, Runway 24L and Runway 25R, and arrivals are to the outboard runways, Runway 24R and Runway 25L. Existing 2012 runway use is shown in **Table 6**.

Table 6

2012 Annual Runway Utilization

	Arrivals				Departures			
Runway	Day	Evening	Night	Total	Day	Evening	Night	Total
06L	0.7%	0.3%	2.3%	0.8%	0.1%	0.0%	0.0%	0.1%
06R	0.0%	0.0%	12.9%	2.0%	0.5%	0.2%	0.2%	0.4%
07L	0.0%	0.0%	8.3%	1.3%	0.9%	0.3%	0.8%	0.8%
07R	0.8%	0.3%	2.8%	1.0%	0.0%	0.0%	0.1%	0.1%
24L	1.8%	3.1%	1.8%	2.1%	40.7%	40.5%	25.2%	37.4%
24R	44.5%	45.1%	29.9%	42.4%	2.0%	1.1%	1.3%	1.7%
25L	50.1%	47.6%	39.7%	48.1%	3.8%	5.3%	5.7%	4.3%
25R	2.0%	3.7%	2.3%	2.4%	52.0%	52.6%	66.7%	55.1%

Source: Ricondo & Associates, Inc., 2014.

As the INM model produces noise contours representing average annual noise exposure, the 4-month runway closure period and 2-month period with a reduced runway length on Runway 6L-24R had to be annualized with 6 months of normal operations to establish annual noise exposure. By combining the Without Project operations for 183 days, 122 days of the runway closure, and 60 days of the reduced runway length, annual runway use was established, as shown in **Table 7**. Runway utilization for both scenarios were developed from airport simulation models (SIMMOD).

Table 7

LAX Runway Utilization During Construction Year

	Arrivals				Departures			
Runway	Day	Evening	Night	Total	Day	Evening	Night	Total
06L	0.5%	0.2%	1.5%	0.6%	0.0%	0.0%	0.0%	0.0%
06R	0.2%	0.1%	13.4%	2.5%	0.6%	0.2%	0.3%	0.5%
07L	0.0%	0.0%	8.0%	1.4%	0.9%	0.3%	1.1%	0.8%
07R	0.8%	0.3%	2.7%	1.0%	0.0%	0.0%	0.2%	0.1%
24L	13.3%	13.4%	13.6%	13.4%	43.3%	43.6%	30.6%	40.9%
24R	29.6%	29.8%	19.5%	27.9%	1.1%	0.6%	0.8%	1.0%
25L	51.1%	50.4%	37.5%	48.6%	2.7%	3.9%	4.9%	3.3%
25R	4.6%	5.7%	3.7%	4.6%	51.3%	51.3%	62.2%	53.4%

Source: Ricondo & Associates, Inc., 2014.

2.3.5 Aircraft Flight Tracks

The existing and assumed future uses of the runways and flight tracks to and from the Airport are important in determining where aircraft are flying and, consequently, where noise is generated in the Airport environs. Generalized flight tracks (the geographical spread of aircraft operations in terms of overflight density) for LAX for arrivals and departures are available in the Final Environmental Assessment for Los Angeles International Airport (LAX) Runway 7L-25R Runway Safety Area (RSA) and Associated Improvements Project.[7]

2.3.6 Departure Trip Length

Departure trip length, commonly referred to as stage length (unrelated to "Stage" classifications of aircraft for FAR Part 36 noise certification), refers to the non-stop distance an aircraft travels after departure. This information is needed to determine average gross takeoff weights for different aircraft types. The noise generated by departures of a specific aircraft type will vary depending on the takeoff weights of the particular operations. For example, a fully loaded aircraft departing on a long flight will weigh more on departure than the same fully loaded aircraft departing on a shorter flight because the longer flight requires more fuel on board. It usually takes the heavier aircraft longer to reach its takeoff velocity, thereby using more runway length and climbing at a slower rate than a lighter aircraft, particularly on hot days. Therefore, more land area will be exposed to higher levels of aircraft noise by departures of heavier aircraft than departures of the same aircraft with lighter loads.

Table 8 shows the nine different stage length categories included in INM that have been established to represent different departure trip length distances. The INM uses the stage

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7 City of Los Angeles, Los Angeles World Airports, Final Environmental Assessment for Los Angeles International Airport (LAX) Runway 7L/25R Runway Safety Area (RSA) and Associated Improvements Project, August 2013.

length category for each operation to determine which profile to use for a specific aircraft departure. In most cases, using the published departure distances to determine the stage length and therefore the departure profile to be used provides good correlation between noise levels estimated by the INM and measured noise levels.

Table 8

INM Departure Stage Length Categories

Stage Length Category	Range of Departure Trip Length (Nautical Miles)
1	0 – 500
2	500 – 1,000
3	1,000 – 1,500
4	1,500 – 2,500
5	2,500 – 3,500
6	3,500 – 4,500
7	4,500 – 5,500
8	5,500 – 6,500
9	6,500+

Source: Ricondo & Associates, Inc., January 2014.

3.0 CONSTRUCTION EQUIPMENT NOISE

3.1 Noise Analysis Methodology

Construction activities typically generate noise from the operation of equipment required for demolition and construction of various facilities. Noise impacts from on-site construction and construction trucks staging have been evaluated by determining the noise levels generated by different types of construction activity, calculating the construction-related noise level at nearby sensitive receptor locations, and comparing these construction-related noise levels to existing ambient noise levels (i.e., noise levels without construction noise). More specifically, the following steps were undertaken to calculate construction-period noise levels:

1. Ambient noise levels at surrounding sensitive receptor locations were modeled based on aircraft noise in proximity to the nearby noise-sensitive receptors;
2. Typical noise levels for each type of construction equipment were obtained from the Federal Highway Administration (FWHA) Roadway Construction Noise Model (RCNM). Construction equipment, including number and type of equipment, was gathered for each phase/component of construction;
3. Distances between construction site and staging area locations (noise source), and surrounding sensitive receptors were measured using Project plans and aerial imagery;

4. Construction noise levels were calculated for sensitive receptor locations based on the conventional standard point source noise-distance attenuation factor of 6.0 dBA for each doubling of distance. Construction noise levels are quantified at predetermined distances from the site using the equivalent continuous noise level (L_{eq}) metric; and,
5. Calculated noise levels associated with Project construction at sensitive receptor locations were then compared to estimated existing noise levels and the construction noise significance thresholds identified below.

3.2 Roadway Construction Noise Model

Roadway construction is often conducted in close proximity to residences and businesses and should be controlled and monitored in order to avoid excessive noise impacts. In addition to community issues, excessive noise can threaten a construction project's schedule. In general, a project's schedule can be maintained by balancing the type, time of day and duration of construction activities; adhering to local noise control requirements; and being proactive to community concerns. To aid in this process, the U.S. Department of Transportation Federal Highway Administration (FWHA) has developed a construction noise screening tool. The FHWA Roadway Construction Noise Model (RCNM) is a national model for the prediction of construction noise. This model is not required for use on Federal-aid projects; however, it can be used for the prediction of construction noise during the project development and construction phases.

The FHWA RCNM is based on the construction noise prediction spreadsheet developed for the Central Artery/Tunnel Project in Boston, Massachusetts (CA/T Project or "Big Dig") by Parsons Brinckerhoff Quade & Douglas, Inc. The CA/T Project was the largest urban construction project ever conducted in the United States and has the most comprehensive noise control specification ever developed in the United States. FHWA RCNM incorporates the CA/T Project's noise limit criteria and extensive construction equipment noise database, where these parameters can be modified according to each project’s needs. Users can activate and analyze multiple pieces of equipment simultaneously and define multiple receptor locations, including land-use type and baseline noise levels, where the FHWA RCNM will calculate sound level results for multiple metrics.

The intended use for the FHWA RCNM is a construction noise screening tool to predict noise emissions from equipment and determine compliance with noise criteria limits. The model is based on the CA/T prediction spreadsheet, not on the FHWA Traffic Noise Model® (FHWA TNM) or the FHWA Highway Construction Noise Computer Program (HICNOM, developed in 1982). The FHWA RCNM predicts noise from highway construction operations based on a compilation of empirical data and the application of acoustical propagation formulas. It enables the calculation of construction noise levels in more detail than manual methods while avoiding the need to collect extensive amounts of project-specific input data (as is required by HICNOM, a data-intensive and more comprehensive method for construction noise prediction).

The RCNM allows for estimation of three key metrics of interest: L_{max}, L_{eq}, and L_{10} at receptor locations for a construction operation that can include up to 20 pieces of equipment. Input data includes receptor type, distance from construction, construction equipment type, and an “acoustical usage factor”, which is used to estimate the fraction of time each piece of equipment is operating at full power (i.e., its loudest condition). FHWA RCNM Version 1.1 was used to determine construction noise effects from the proposed Project.

3.3 Basic Data and Assumptions

Input data used in the RCNM model is discussed in the following sections. General settings and assumptions include:

- Default acoustical usage factors per piece of equipment.
- Actual sampled data was used for determining noise impacts, instead of specification data (where available).
- Noise mitigation devices, such as barriers, were not incorporated into the model. Therefore, noise effects are conservative.

3.3.1 Ambient Noise Levels

The existing noise environment at and around the proposed Project site consists of noise from airport-related activities including aircraft departing, landing, and taxiing on runways and connecting taxiways; and noise from vehicular traffic movements on local roadways. Some land uses are considered more sensitive to intrusive noise than others due to the amount of noise exposure and the types of activities typically involved at the receptor location. The *L.A. CEQA Thresholds Guide* states that residences, schools, motels and hotels, libraries, religious institutions, hospitals, nursing homes, and parks are generally more sensitive to noise than commercial and industrial land uses.

Potential noise sensitive locations that may be affected by construction of the proposed Project were identified based on reviews of Project plans, GIS, and aerial imagery. Since the proposed Project site is located on the north side of the airport, the identification of noise-sensitive locations focused on areas in Westchester, with an additional noise-sensitive location identified near one of the staging areas. **Figure 1** depicts the construction and construction staging areas, and closest noise-sensitive receptor areas.

Ambient noise levels for noise-sensitive areas were modeled in INM based on 2012 data from LAX. Data pertaining to aircraft operations, fleet mix, time of day, and runway use for the existing 2012 scenario are discussed above in Section 2.3. Noise-sensitive areas were chosen based on proximity to the construction area and construction staging locations. The ambient noise levels take into account only aircraft overflight noise; noise from local roadways has not been included. Noise levels at these locations were modeled to determine baseline L_{eq} values, as shown in **Table 9**.

Table 9

Background Noise Levels at Noise-Sensitive Receptor Areas

ID #	Location	Existing Conditions L_{eq} (dB)
1	Residential Uses in Playa Del Ray	63.8
2	Saint Bernard High School	62.0
3	Residential uses along southern edge of Westchester	63.6
4	Park West Apartments on Lincoln Boulevard	62.3
5	Residential uses along West 88th Street	60.9
6	Park Westchester Condominiums on Sepulveda Eastway	72.1
7	Residential Uses within City of Inglewood	59.5

Source: Ricondo & Associates, Inc., 2014.

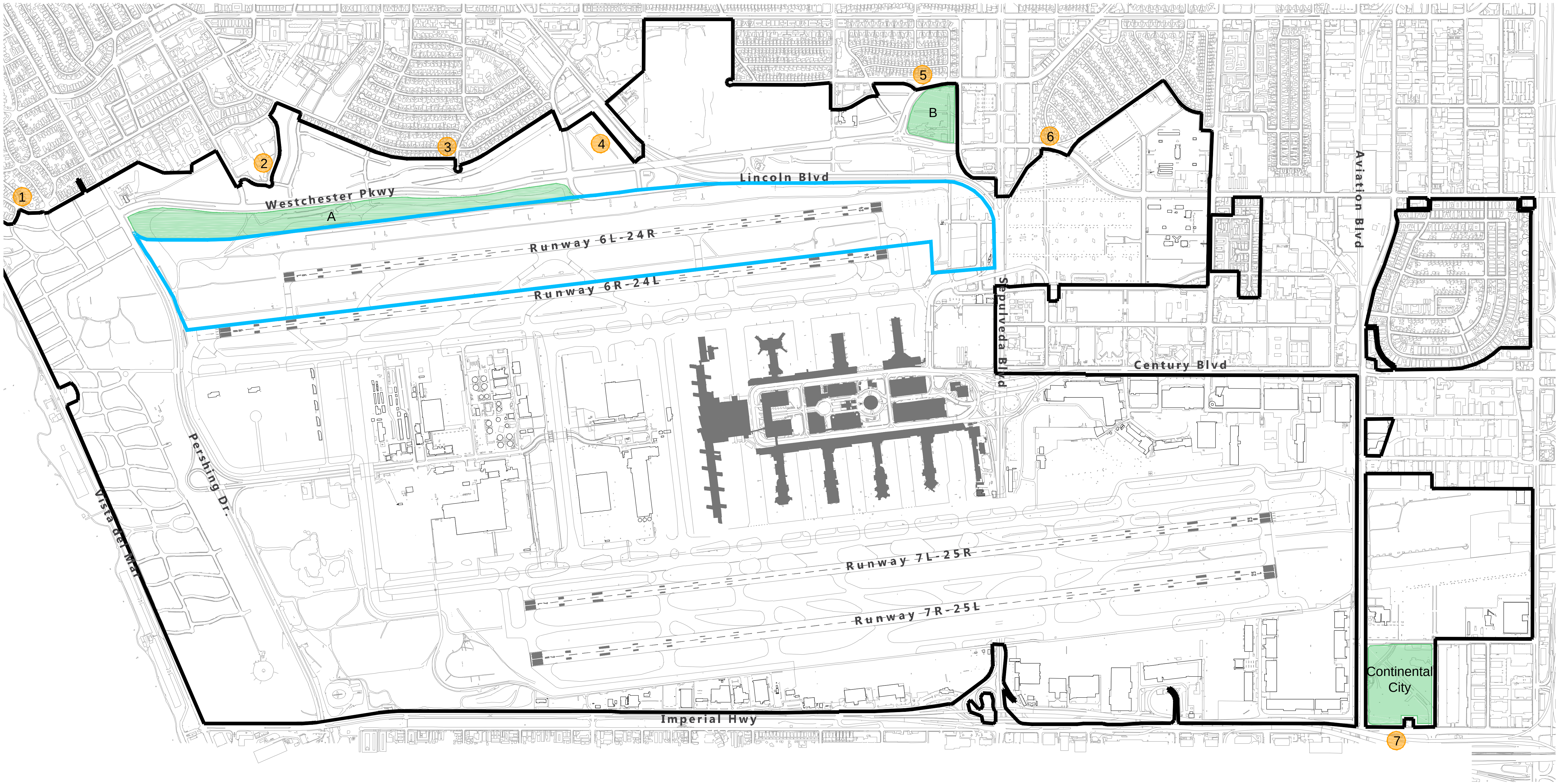
3.3.2 Construction Equipment

Sources of construction noise estimated in this analysis included construction vehicles and equipment. Construction equipment is classified as on-site off-road equipment, such as bulldozers, backhoes and front end loaders. Construction vehicles are made up of on-road equipment including delivery semi-trucks, pickup and flatbed trucks, truck tractors and road sweepers. On-road construction equipment are mostly street legal vehicles that can be operated on public roads.

Construction activity estimates, including types, number, and specifications of equipment for various construction activities, were derived from data provided by MARRS Services, Inc., in support of the LAX Runway 7L/25R RSA EA.[8] This data included various types and numbers of construction equipment organized into crews. Crews were assigned to specific construction activities associated with the proposed Project by identifying activities that are similar in nature to activities included in the LAX Runway 7L/25R RSA EA. Equipment for each phase of the construction schedule was compiled. The construction phases assumed to have the greatest potential impact (those associated with grading/paving) were analyzed at the construction areas closest to noise-sensitive sites. These include the Runway 6L-24R pavement rehabilitation and the construction of a relocated service road located near the intersection of Lincoln Boulevard and Sepulveda Boulevard. A complete list of construction equipment for each of these phases is shown in **Table 10**. Also included in Table 10 are the on-road construction vehicles assumed at the construction staging areas.

[8] City of Los Angeles, Los Angeles World Airports, Final Environmental Assessment for Los Angeles International Airport (LAX) Runway 7L/25R Runway Safety Area (RSA) and Associated Improvements Project, August 2013.

Confidential Draft Deliberative Material



0 1,500 ft.
Scale north

Source: Landrum & Brown, *Los Angeles International Airport, Airport Layout Plan*, 2005; Ricondo & Associates, Inc., October 2013.
Prepared by: Ricondo & Associates, Inc., February 2014.

1. Residential Uses in Playa Del Rey
2. Saint Bernard High School
3. Residential Uses Along Southern Edge of Westchester
4. Park West Apartments Northwest on Lincoln Blvd. South of La Tijera Blvd.
5. Residential Uses Along West 88th Street Between Liberator Ave. and Sepulveda Westway
6. Park Westchester Condominiums
7. Residential Uses within Del Aire

Legend
- 1 Sensitive Noise Receptor Area
- A Potential Construction Staging Area
- LAX Property Boundary
- Construction Area

Runway 6L-24R and Runway 6R-24L Runway Safety Area and Associated Improvments Draft EIR	Construction Noise Analysis Sensitive Noise Receptor Areas and Potential Construction Staging Areas	Figure 1

Table 10

Construction Equipment by Phase

Runway 6L-24R Rehabilitation	Relocated Service Road	Construction Staging Areas
Asphalt Paver, 130 HP	Asphalt Paver, 130 HP	Concrete Batch Plant [1]
Backhoe Loader, 48 HP	Backhoe Loader, 48 HP	Dump Trailer, 16.5 CY
Belt Placer	Cable Pulling Rig	Flatbed Truck
Cable Pulling Rig	Cable Trailer	Pickup Trucks, 3/4 Ton
Cable Trailer	Compactor, Roller, Vibrator	Truck Tractor, 6x4, 450 HP
Concrete Paver	Dist. Tanker, 3000 Gallon	Water Tank Trailer, 5000 Gal
Concrete Saw	Dozer, 300 HP	
Cure/Texture Rig	Dump Trailer, 16.5 CY	
Dozer, 300 HP	FE Loader, W.M., 4 CY	
FE Loader, W.M., 4 CY	Flatbed Truck	
Flatbed Truck	Grader, 30,000 lbs	
Grader, 30,000 lbs	Heating Kettle, 115 Gallon	
Heating Kettle, 115 Gallon	Hyd. Excavator, 1 C.Y.	
Hyd. Hammer (1200 lbs)	Hyd. Hammer (1200 lbs)	
Paint Thermo. Striper, TM	Paint Thermo. Striper, TM	
Pavt. Rem. Bucket	Pavt. Rem. Bucket	
Pickup Trucks, 3/4 Ton	Pickup Trucks, 3/4 Ton	
Pvmt. Profiler, 750 HP	Roller, Pneum., Whl., 12 Ton	
Road Sweeper, S.P., 8' wide	S.P. Crane, 4x4, 5 Ton	
Roller, Pneum., Whl., 12 Ton	Scraper, Towed, 10 C.Y.	
S.P. Crane, 4x4, 5 Ton	Tandem Roller, 10 Ton	
Scraper, Towed, 10 C.Y.	Tensioning Rig	
Tandem Roller, 10 Ton	Truck Tractor, 6x4, 450 HP	
Tensioning Rig	Water Tank Trailer, 5000 Gal	
Water Tank, 65 Gal		

Note:
1 Operations of a concrete batch plant were only assumed at the Continental City construction staging area.

Source: Ricondo & Associates, Inc., January 2014.

Construction equipment to be utilized for the relative phases of construction, along with distances to the nearest noise-sensitive areas, was input into the RCNM model. The model uses **Equation 1** to determine the maximum noise level for each noise-sensitive area. **Equation 2** shows the calculation for the equivalent continuous noise level (L_{eq}) for a single piece of equipment. **Equation 3** shows the calculation for summing the equivalent continuous noise level from all pieces of construction equipment.

Equation 1

Maximum Noise Level (L_{max}) Calculation

$$L_{max} = selected\_L_{max} - 20 \log (D/50) - shielding$$

Where:

L_{max}	=	maximum noise level (dBA)
$selected\_L_{max}$	=	specification or actual maximum A-weighted sound level at 50 feet (dBA)
D	=	distance between the equipment and receptor (feet)
shielding	=	Insertion loss of any barriers or mitigation (dBA)

Source: U.S. Department of Transportation, Federal Highway Administration, Roadway Construction Noise Model User's Guide, January 2006.

Equation 2

Equivalent Continuous Noise Level (L_{eq}) Calculation

$$L_{eq} = L_{max} + 10 \log (UF/100)$$

Where:

L_{eq}	=	equivalent continuous noise level (dBA)
L_{max}	=	maximum noise level (dBA)
UF	=	time-averaging usage factor (%)

Source: U.S. Department of Transportation, Federal Highway Administration, Roadway Construction Noise Model User's Guide, January 2006.

Equation 3

Total Construction L_{eq}

$$\text{Total Construction } L_{eq} = 10 * \log(\Sigma \text{ (individual equipment } L_{eq} \text{ values}^3))$$

Source: U.S. Department of Transportation, Federal Highway Administration, Roadway Construction Noise Model User's Guide, January 2006.

Outputs from the RCNM model include the collective noise from all construction equipment, in both L_{eq} and L_{max}, for each receptor. The L_{eq} values were added to ambient noise levels to determine total noise at each receptor using **Equation 4**, and then compared against significance thresholds. Calculation sheets for construction equipment are included in **Attachment F.1**.

Equation 4

Total (Ambient and Construction) L_{eq}

$$\text{Total Leq} = 10 * \text{Log}_{10}\left(10^{\frac{\text{La}}{10}} + 10^{\frac{\text{Lc}}{10}}\right)$$

Where:

L_a = ambient noise (dBA)
L_c = total construction L_{eq} from Equation 3 (dBA)

Source: U.S. Department of Transportation, Federal Highway Administration, Roadway Construction Noise Model User's Guide, January 2006.

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Attachment F.1

Construction Noise Results

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/28/2014
Case Description: 6L-24R RSA Construction

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
ID #1	Residential	63.8	63.8	63.8

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Dump Truck	No	40		76.5	650.0	0.0
Pickup Truck	No	40		75.0	650.0	0.0
Flat Bed Truck	No	40		74.3	650.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Dump Truck	54.2	50.2	68.8	68.8	68.8	68.8	68.8	68.8	None	None	None	None	None	None
Pickup Truck	52.7	48.7	68.8	68.8	68.8	68.8	68.8	68.8	None	None	None	None	None	None
Flat Bed Truck	52.0	48.0	68.8	68.8	68.8	68.8	68.8	68.8	None	None	None	None	None	None
Total	54.2	53.8	68.8	68.8	68.8	68.8	68.8	68.8	None	None	None	None	None	None

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/28/2014
Case Description: 6L-24R RSA Construction

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
ID #2	Residential	62.0	62.0	62.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Dump Truck	No	40		76.5	1460.0	0.0
Pickup Truck	No	40		75.0	1460.0	0.0
Flat Bed Truck	No	40		74.3	1460.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Dump Truck	47.1	43.2	67.0	67.0	67.0	67.0	67.0	67.0	None	None	None	None	None	None
Pickup Truck	45.7	41.7	67.0	67.0	67.0	67.0	67.0	67.0	None	None	None	None	None	None
Flat Bed Truck	44.9	41.0	67.0	67.0	67.0	67.0	67.0	67.0	None	None	None	None	None	None
Total	47.1	46.8	67.0	67.0	67.0	67.0	67.0	67.0	None	None	None	None	None	None

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/28/2014
Case Description: 6L-24R RSA Construction

**** Receptor #3 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
ID #3	Residential	63.6	63.6	63.6

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Dump Truck	No	40		76.5	500.0	0.0
Pickup Truck	No	40		75.0	500.0	0.0
Flat Bed Truck	No	40		74.3	500.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Dump Truck	56.5	52.5	68.6	68.6	68.6	68.6	68.6	68.6	None	None	None	None	None	None
Pickup Truck	55.0	51.0	68.6	68.6	68.6	68.6	68.6	68.6	None	None	None	None	None	None
Flat Bed Truck	54.3	50.3	68.6	68.6	68.6	68.6	68.6	68.6	None	None	None	None	None	None
Total	56.5	56.1	68.6	68.6	68.6	68.6	68.6	68.6	None	None	None	None	None	None

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/28/2014
Case Description: 6L-24R RSA Construction

**** Receptor #4 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
ID #4	Residential	62.3	62.3	62.3

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Paver	No	50		77.2	1089.0	0.0
Backhoe	No	40		77.6	1089.0	0.0
Concrete Saw	No	20		89.6	1089.0	0.0
Front End Loader	No	40		79.1	1089.0	0.0
Flat Bed Truck	No	40		74.3	1089.0	0.0
Grader	No	40	85.0		1089.0	0.0
Pickup Truck	No	40		75.0	1089.0	0.0
Roller	No	20		80.0	1089.0	0.0
Scraper	No	40		83.6	1089.0	0.0
Dozer	No	40		81.7	1089.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Paver	50.5	47.4	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None
Backhoe	50.8	46.8	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None
Concrete Saw	62.8	55.8	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None
Front End Loader	52.3	48.4	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None
Flat Bed Truck	47.5	43.5	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None
Grader	58.2	54.3	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None
Pickup Truck	48.2	44.3	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None
Roller	53.2	46.2	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None
Scraper	56.8	52.8	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None
Dozer	54.9	50.9	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None
Total	62.8	60.9	67.3	67.3	67.3	67.3	67.3	67.3	None	None	None	None	None	None

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/28/2014
Case Description: 6L-24R RSA Construction

**** Receptor #5 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
ID #5	Residential	60.9	60.9	60.9

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Dump Truck	No	40		76.5	150.0	0.0
Pickup Truck	No	40		75.0	150.0	0.0
Flat Bed Truck	No	40		74.3	150.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Dump Truck	66.9	62.9	65.9	65.9	65.9	65.9	65.9	65.9	1.0	None	1.0	None	1.0	None
Pickup Truck	65.5	61.5	65.9	65.9	65.9	65.9	65.9	65.9	None	None	None	None	None	None
Flat Bed Truck	64.7	60.7	65.9	65.9	65.9	65.9	65.9	65.9	None	None	None	None	None	None
Total	66.9	66.6	65.9	65.9	65.9	65.9	65.9	65.9	1.0	0.7	1.0	0.7	1.0	0.7

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/28/2014
Case Description: 6L-24R RSA Construction

**** Receptor #6 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
ID #6	Residential	72.1	72.1	72.1

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Paver	No	50		77.2	1252.0	0.0
Backhoe	No	40		77.6	1252.0	0.0
Front End Loader	No	40		79.1	1252.0	0.0
Flat Bed Truck	No	40		74.3	1252.0	0.0
Grader	No	40	85.0		1252.0	0.0
Pickup Truck	No	40		75.0	1252.0	0.0
Roller	No	20		80.0	1252.0	0.0
Crane	No	16		80.6	1252.0	0.0
Scraper	No	40		83.6	1252.0	0.0
Compactor (ground)	No	20		83.2	1252.0	0.0
Dozer	No	40		81.7	1252.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Paver	49.2	46.2	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Backhoe	49.6	45.6	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Front End Loader	51.1	47.2	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Flat Bed Truck	46.3	42.3	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Grader	57.0	53.0	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Pickup Truck	47.0	43.0	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Roller	52.0	45.0	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Crane	52.6	44.6	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Scraper	55.6	51.6	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Compactor (ground)	55.3	48.3	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Dozer	53.7	49.7	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None
Total	57.0	58.7	77.1	77.1	77.1	77.1	77.1	77.1	None	None	None	None	None	None

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/28/2014
Case Description: 6L-24R RSA Construction

**** Receptor #7 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
ID #7	Residential	59.5	59.5	59.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Dump Truck	No	40		76.5	800.0	0.0
Pickup Truck	No	40		75.0	800.0	0.0
Flat Bed Truck	No	40		74.3	800.0	0.0
Concrete Batch Plant	No	15	83.0		800.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Dump Truck	52.4	48.4	64.5	64.5	64.5	64.5	64.0	64.0	None	None	None	None	None	None
Pickup Truck	50.9	46.9	64.5	64.5	64.5	64.5	64.0	64.0	None	None	None	None	None	None
Flat Bed Truck	50.2	46.2	64.5	64.5	64.5	64.5	64.0	64.0	None	None	None	None	None	None
Concrete Batch Plant	58.9	50.7	64.5	64.5	64.5	64.5	64.0	64.0	None	None	None	None	None	None
Total	58.9	54.4	64.5	64.5	64.5	64.5	64.0	64.0	None	None	None	None	None	None