APPENDIX R

Environmental Noise Analysis

PROJECT DESCRIPTION

The proposed project is a casino complex, to be located in the southeast quadrant of Stony Point Road and Wilfred Avenue in Sonoma County, California. The facility would include a casino, a hotel, a parking structure and parking lots, an on-site waste water treatment plant, and a central plant building.

Five development alternatives are being considered, ranging from the preferred casino on two different portions of the site, a reduced casino, commercial development alone, and a casino on a different site on Lakeville Highway near SR37.

The project alternatives would introduce new or additional noise sources adjacent to existing rural land uses. In addition, development of the Stony Point Road site would be near a mobile home park. The noise assessment will focus on the potential effects of these sources on noise sensitive land uses.

REGULATORY SETTING

Significance of Changes in Ambient Noise Levels

Some guidance as to the significance of changes in ambient noise levels is provided by the 1992 findings of the Federal Interagency Committee on Noise (FICON), which assessed the annoyance effects of changes in ambient noise levels resulting from aircraft operations. The FICON recommendations are based upon studies that relate aircraft and traffic noise levels to the percentage of persons highly annoyed by the noise. Annoyance is a summary measure of the general adverse reaction of people to noise that generates speech interference, sleep disturbance, or interference with the desire for a tranquil environment.

The rationale for the FICON recommendations is that it is possible to consistently describe the annoyance of people exposed to transportation noise in terms of L_{dn}. The changes in noise exposure that are shown in Table II are expected to result in equal changes in annoyance at sensitive land uses. Although the FICON recommendations were specifically developed to address aircraft noise impacts, they are used in this analysis for traffic noise described in terms of L_{dn}.

TABLE II
MEASURES OF
SUBSTANTIAL INCREASE FOR TRANSPORTATION NOISE EXPOSURE

Ambient Noise Level Without Project (Ldn)	Significant Impact Assumed to Occur if the Project Increases Ambient Noise Levels By:
<60 dB	+ 5 dB or more
60-65 dB	+3 dB or more
>65 dB	+1.5 dB or more

Source: FICON, 1992.

For non-transportation noise sources affecting noise sensitive land uses, an increase in ambient noise levels of 5 dBA is considered to be potentially significant.

Significance of Cumulative Noise Levels

The cumulative noise levels associated with a project may be significant if they exceed normally acceptable limits. The basic test of significance is whether the resulting noise levels would be expected to annoy a reasonable person of normal sensitiveness.

Federal recommendations for acceptable noise levels at residential receivers are generally in the range of 55 dB L_{dn} to 65 dB L_{dn}, based upon the recommendations contained in the U.S. EPA "Levels Document"[1] and upon the 65 dB L_{dn} criterion applied by the U.S. Department of Housing and Urban Development[2] and other federal agencies. These criteria are typically applied to noise from transportation noise sources, but may be used to assess the compatibility of other noise sources relative to residential land uses, provided that consideration is given to potential disturbances due to impulsive sound, tonal content (whistles, music, etc.), and the prevalence of nighttime activities.

For other noise sources, especially those that may occur over short periods of the day or night, it is common to apply noise criteria based upon hourly noise levels, making a distinction between noise levels produced during daytime and nighttime hours. Acceptable hourly noise levels in residential areas are usually considered to be in the range of 50 to 55 dB (average) during daytime hours and 45 to 50 dB (average) during nighttime hours. (The lower noise level limits would be appropriate in areas that currently have low ambient noise levels.) Hourly noise standards are usually expressed in terms of average (L_{eq}) or median (L_{50}) noise levels, and they often are corrected for the presence of impulsive sounds and tonal content.

Construction Noise Levels

Noise due to construction activities may be considered to be insignificant if:

- the construction activity is temporary;
- use of heavy equipment and noisy activities is limited to daytime hours;
- no pile driving or surface blasting is planned; and
- all industry-standard noise abatement measures are implemented for noise-producing equipment.

NOISE IMPACT ASSESSMENT

Ambient Noise Levels

The project areas include agricultural and rural residential land uses. A mobile home park is located at the southeast corner of the preferred project site, in the City of Rohnert Park.

To describe ambient noise levels in the project area, BBA conducted continuous noise level measurements on both project sites. At Stony Point Road (Alternative Site A), the ambient noise measurement site was located about 425 feet south of Wilfred Avenue and about 1,000 feet east

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[1] Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety, U.S. Environmental Protection Agency, 550-9-74-004, March 1974.

[2] 24 CFR Part 51, Subpart B, Section 51.103c.

of Stony Point Road. At Lakeville Highway (Alternative Site E), the ambient noise measurement site was located about 50 feet from the centerline of that roadway. Table III lists the measured Day-Night Levels (L_{dn}) measured at each site over the period from October 14 through October 20, 2004. Figures 1 and 2 show the noise measurement sites.

TABLE III
MEASURED AMBIENT NOISE LEVELS
GRATON RANCHERIA CASINO PROJECT

Date	Day of Week	L_{dn}, dB	
		Alternative Site A	Alternative Site E
October 14, 2004	Thursday	54.9	72.8
October 15, 2004	Friday	54.4	72.8
October 16, 2004	Saturday	51.6	70.4
October 17, 2004	Sunday	51.5	--
October 18, 2004	Monday	52.5	--
October 19, 2004	Tuesday	60.3	--
October 20, 2004	Wednesday	49.9	--
Average:		55.0	72.1

At the Stony Point project site, noise from traffic on area roadways dominates the local noise environment. At the Lakeville Highway site, noise from traffic on that roadway was dominant.

Figures B-1 through B-14 (in Appendix B) show the results of the continuous noise level measurements in terms of statistical descriptors of hourly noise levels. At Alternative Site E (Lakeville Road) only 3 full days worth of data were obtained due to a meter malfunction caused by high winds and heavy rains that began on Sunday, October 17.

Other noise sources present in the vicinities of both project sites include occasional aircraft over flights, use of farm equipment, and electric water pumps.

Roadway Traffic Noise

The traffic noise study was prepared using a combination of noise measurements and traffic noise modeling. The traffic noise measurements performed near the project sites were used to calibrate the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) for traffic on the nearest roadways. In addition, the ambient noise measurement data were used to derive the average day-night traffic noise distribution factor for traffic noise modeling in terms of L_{dn}.

Noise measurement equipment consisted of Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters, which were equipped with B&K Type 4176 ½" microphones. The measurement equipment was calibrated immediately before use, and meets the specifications of the American National Standards Institute (ANSI) for Type 1 sound measurement systems.

The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA RD-77-108) was employed for the prediction of traffic noise levels. The FHWA model is the analytical method currently favored for traffic noise prediction by most state and local agencies. It is applied to federal and state roadway projects by the California Department of

Transportation (Caltrans). The model is based upon the CALVENO noise emission factors for
Figure 1

Figure 1
Ambient Noise Measurement Site
Alternative Sites A, B, C and D

Figure 2
Ambient Noise Measurement Site
Alternative Site E

automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site.

The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions, and is considered to be accurate within 1.5 dB. To predict L_{dn} values, it is necessary to determine the day/night distribution of traffic and to adjust the traffic volume input data to yield an equivalent hourly traffic volume.

Short-term traffic noise level measurements were conducted adjacent to both alternative project sites on October 13, 2004. The purpose of the noise measurements was to determine the accuracy of the FHWA model in predicting traffic noise for the roadways affecting the project sites. The temperature was about 90 degrees Fahrenheit, and the sky was clear. Humidity was medium, and wind was approximately 0-5 mph from the west. Short-term traffic counts were conducted during the measurement period.

The noise measurements were conducted in terms of the L_{eq}, and the measured values were later compared to the values predicted by the FHWA model using the observed traffic volumes, speed, and distance to the microphones. Table IV compares the measured and modeled noise levels for the observed traffic conditions.

TABLE IV
NOISE MEASUREMENT SUMMARY
AND FHWA MODEL CALIBRATION

Roadway	Sites	Vehicles per Hour			Posted Speed (mph)	Distance (feet)*	Measured L_{eq}, dB	Modeled L_{eq}, dB**
		Autos	Medium Trucks	Heavy Trucks				
Rohnert Park Expressway	A-D	624	12	16	35	35	70.2	66.3
Stony Point Road	A-D	496	40	16	50	45	70.8	68.1
Wilfred Avenue	A-D	100	0	0	40	30	58.4	60.2
Lakeville Highway	E	1044	28	68	55	35	76.1	74.2

* Distance is measured from the roadway centerline.
** Acoustically "soft" site assumed

The FHWA model under predicted the measured average noise levels for traffic on Rohnert Park Expressway, Stony Point Road, and Lakeville Highway by about 2 to 4 dB. This was likely due to accelerating vehicles and vehicles traveling over the speed limit. The FHWA model over predicted traffic noise levels for Wilfred Avenue, probably due to actual vehicle speeds being lower than 40 mph on the existing narrow roadway. For this study, +2 dB corrections were applied to the FHWA model for Stony Point Road and Lakeville Highway, and a +4 dB correction was applied to the model for Rohnert Park Expressway.

For the traffic noise impact analysis, it was assumed that worst-case noise exposures would occur at reference distances of 50 feet from the centerlines of the roadways. Truck mix was estimated from the short-term traffic counts and from Caltrans data. Day-night distribution of traffic noise was estimated as 87%/13%.

Based upon the traffic volume analysis prepared for this project by Kimly-Horn & Associates, Inc., the FHWA model was run to predict existing and future traffic noise levels for the roadways included in the traffic analysis. Table V lists the FHWA model traffic volume input assumptions.

TABLE V
TRAFFIC VOLUME ASSUMPTIONS FOR NOISE MODELING

Roadway	Segment	Existing	Future Baseline	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Rohnert Park Expressway	At Sites A-D	10,930	11,580	15,740	13,920	14,450	12,740	N/A
Stony Point Road	At Sites A-D	15,060	20,050	27,350	24,670	25,090	22,200	N/A
Wilfred Avenue	At Sites A-D	2,290	10,060	24,320	17,090	19,950	14,000	N/A
Redwood Highway	Between Rohnert Park Expressway and Wilfred Avenue	18,690	27,330	27,330	27,330	27,330	27,330	N/A
Commerce	Between Rohnert Park Expressway and Wilfred Avenue	12,530	22,520	22,520	22,520	22,520	22,520	N/A
SR 37	At Lakeville Highway	36,220	43,300	N/A	N/A	N/A	N/A	52,240
SR 37	At SR 121	27,660	35,340	N/A	N/A	N/A	N/A	44,490
Lakeville Highway	At SR 37	5,250	28,850	N/A	N/A	N/A	N/A	51,720
SR 121	At SR 37	17,130	21,190	N/A	N/A	N/A	N/A	22,340

Table VI shows the predicted traffic noise levels for future conditions on each roadway for each scenario, at the reference distance of 50 feet from the roadway centerline.

TABLE VI
PREDICTED TRAFFIC NOISE LEVELS AT REFERENCE DISTANCES

Roadway	Segment	Predicted L_{dn}, dB						
		Existing	Future Baseline	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Rohnert Park Expressway	At Sites A-D	70.2	70.4	71.7	71.2	71.4	70.8	N/A
Stony Point Road	At Sites A-D	73.3	74.6	75.9	75.5	75.6	75.0	N/A
Wilfred Avenue	At Sites A-D	59.9	66.3	70.2	68.7	69.3	67.8	N/A
Redwood Highway	Between Rohnert Park Expressway and Wilfred Avenue	67.8	69.5	69.5	69.5	69.5	69.5	N/A
Commerce	Between Rohnert Park Expressway and Wilfred Avenue	64.7	67.3	67.3	67.3	67.3	67.3	N/A
SR 37	At Lakeville Highway	77.9	78.7	N/A	N/A	N/A	N/A	79.5
SR 37	At SR 121	75.2	76.3	N/A	N/A	N/A	N/A	77.3
Lakeville Highway	At SR 37	70.1	77.5	N/A	N/A	N/A	N/A	80.0
SR 121	At SR 37	72.2	73.1	N/A	N/A	N/A	N/A	73.3

Table VII shows the predicted changes in traffic noise levels, as compared to existing or future cumulative conditions

TABLE VII CHANGES IN PREDICTED TRAFFIC NOISE LEVELS AT REFERENCE DISTANCES								
Roadway	Segments	Predicted L_{dn}, dB						
		Existing	Future Baseline minus Existing	Alt. A minus Future	Alt. B minus Future	Alt. C minus Future	Alt. D minus Future	Alt. E minus Future
Rohnert Park Expressway	At Sites A-D	N/A	0.2	1.3	0.8	1	0.4	N/A
Stony Point Road	At Sites A-D	N/A	1.3	1.3	0.9	1	0.4	N/A
Wilfred Avenue	At Sites A-D	N/A	6.4	3.9	2.4	3	1.5	N/A
Redwood Highway	Between Rohnert Park Expressway and Wilfred Avenue	N/A	1.7	0	0	0	0	N/A
Commerce	Between Rohnert Park Expressway and Wilfred Avenue	N/A	2.6	0	0	0	0	N/A
SR 37	At Lakeville Highway	N/A	0.8	N/A	N/A	N/A	N/A	0.8
SR 37	At SR 121	N/A	1.1	N/A	N/A	N/A	N/A	1
Lakeville Highway	At SR 37	N/A	7.4	N/A	N/A	N/A	N/A	2.5
SR 121	At SR 37	N/A	0.9	N/A	N/A	N/A	N/A	0.2
Note: Shaded cells indicate a significant change in noise levels.								

Table VI shows that noise associated with future traffic would exceed the 65 dB L_{dn} land use compatibility criterion if noise sensitive development were present or proposed immediately adjacent to the affected roadways. This condition would occur with or without the project.

Based upon Table VII, traffic noise levels along Wilfred Avenue would increase by up to 3.9 dB with the project (Alternative A) as compared to the future baseline condition. Using the FICON criteria, the predicted changes in traffic noise levels on that roadway due to Alternatives A, B and C would be significant for the noise sensitive receivers located along that roadway. This would be a significant noise impact.

Traffic noise levels along Lakeville Highway would increase by 2.5 dB with the alternative project (Alternative E) as compared to the future baseline condition. Using the FICON criteria, the predicted change in traffic noise levels on that roadway due to Alternative E would be significant for the noise sensitive receivers located along that roadway. This would be a significant noise impact.

Noise Associated with Project Facilities and Equipment

Construction Noise

During the construction phase of the project, noise from construction would dominate the noise environment in the immediate area. Equipment used for construction would generate noise levels as indicated in Table VIII. Maximum noise levels from different types of equipment under different operating conditions could range from 70 dBA to 90 dBA at a distance of 50 feet. Construction activities would be temporary in nature, typically occurring during normal working hours. Construction noise impacts could be significant, as nighttime operations or use of unusually noisy equipment could result in annoyance or sleep disruption for nearby residences. However, the temporary nature of construction noise would result in a less than significant effect.

TABLE VIII
TYPICAL CONSTRUCTION NOISE LEVELS

Type of Equipment	Maximum Noise Level, dBA at 50 feet
Scrapers	88
Bulldozers	87
Heavy Trucks	88
Backhoe	85
Pneumatic Tools	85

The most important project-generated construction traffic noise source would be truck traffic associated with transport of heavy materials and equipment. This noise increase would be of short duration and limited primarily to daytime hours, thus the impacts would be less than significant.

Other Noise Sources

The project will include other potentially significant noise sources, primarily traffic and human activities in parking lots, use of fans for heating and ventilation (HVAC), truck loading or unloading areas, tour bus parking, the wastewater treatment plant, and the central plant building. Alternative E also includes a small amphitheatre.

Noise due to traffic in parking lots is limited by the low speeds, so that the noise from this source is not usually expected to be significant. Human activity in parking lots which can produce noise includes talking, yelling, and opening and closing of car doors and trunk lids. Such activities can occur anytime of the day, but will primarily occur near and during casino hours. The noise levels associated with these activities cannot be precisely defined because of the variables such as number of parking movements, time of day and the like. It is typical for a passing car in a parking lot to produce a maximum noise level of 60 dB to 65 dB at a distance of 50 feet, which is comparable to the level of a raised voice. If parking structures are built, their surfaces can cause reflections of sound, so that noise from traffic and human activities will seem magnified, with potential adverse effects on nearby residents.

This project and alternatives include parking lots in various locations. In Alternatives A, C and D, the nearest noise sensitive land uses would be the houses located opposite the sites on Wilfred

Avenue. These houses would be as close as 100 feet from the proposed parking lots. Maximum noise levels at that location due to cars moving in the parking lot would occur occasionally, in the range of 54 dB to 59 dB. Since the average noise levels would be lower than normally acceptable levels, noise from the parking lots is not expected to be significant at the nearest residences.

In Alternative B, the nearest adjacent residential property would also be about 100 feet from the proposed parking lot, across Whistler Avenue. Maximum noise levels at that location due to cars moving in the parking lot would be expected to be in the range of 54 dB to 59 dB. Traffic would also be present on the parking lot access road, which would produce maximum noise levels in the same range. Since the average noise levels would be lower than normally acceptable levels, noise from parking lot traffic and activity is not expected to be significant at the nearest residences.

In Alternative E, the nearest adjacent residential property would also be about 700 feet north the proposed parking lot, across Lakeville Highway. Maximum noise levels at that location due to cars moving in the parking lot would be expected to be in the range of 37 dB to 42 dB. Existing traffic on Lakeville Highway would produce noise levels exceeding these values, as demonstrated by the ambient noise monitoring data. Noise from parking lot traffic and activity is not expected to be significant at the nearest residences, since ambient noise levels would exceed those levels.

The 2000-car parking structure proposed for the project would be located adjacent to the casino in Alternatives A and C. This would be about 700 feet from the north property line. Maximum noise levels from cars moving in and near the parking structure would be about 37 dB to 42 dB at the property line, which would be less than significant, since the average noise levels would be lower than normally acceptable levels.

In Alternative E, the parking structure would be located about 2,200 feet from the nearest residence. Maximum noise levels from cars moving in and near the parking structure would be about 27 dB to 32 dB at the property line, which would be less than significant, since ambient noise levels would exceed those levels.

Noise from fans and other HVAC equipment can be quantified once the project design has been developed. The greatest potential for significant noise effects would occur if fans or similar equipment were located near to sensitive receivers. In this case, the casino and/or commercial buildings would be equipped with HVAC fans which could be significant noise sources. These buildings would be located about 100 feet from the nearest property line (in Alternative B), but would be located at greater distances from the nearest sensitive receivers in the other alternatives. Since there noise sensitive land uses are adjacent to the project site in Alternative B, noise from HVAC equipment or fans could exceed normally acceptable levels, and could be significant.

Loading areas for food and other supplies can be significant noise sources due primarily to the noise produced by passing trucks. Although the trucks would be moving at low speeds, the engine noise could be significant (typically 70 dB to 75 dB at 50 feet), and the number and time of day of truck deliveries could affect the reactions of nearby noise sensitive receivers. Loading docks would be at the rear of the casino building, and would be located more than 600 feet from the nearest noise sensitive use in all of the alternatives. Maximum noise levels due to truck movements at the loading docks would be in the range of 48 to 53 dBA, without accounting for the shielding provided by the casino building. This noise exposure would be less than significant in terms of compliance with local noise standards. However, at some locations, loading dock noise would be audible during the quietest hours of the night, and could be significant due to an increase in ambient noise levels during those hours.

The noise level due to an idling modern diesel bus could be in the range of 65 dBA at 50 feet. Therefore tour buses parked on the project site could be significant noise sources if allowed to idle for long periods adjacent to noise sensitive uses, causing noise levels to exceed normally acceptable limits.

The wastewater treatment plant design is not established at this time. Treatment plant machinery may include blowers, motors and sprays. These noise sources could be significant if the wastewater treatment plant were to be located adjacent to noise sensitive uses, and if noise levels were to exceed normally acceptable limits. In all of the alternatives, the wastewater treatment plant would be located far from the nearest sensitive uses, and would be shielded by the casino building to the north in Alternatives A-D, and to the east in Alternative B.

The central plant building could house machinery using fans, pumps and compressors. These noise sources could be significant if the equipment were to be located adjacent to noise sensitive uses, and if noise levels were to exceed normally acceptable limits. In all of the alternatives, the central plant building would be located far from the nearest sensitive uses, and would be shielded by the casino building to the north in Alternatives A-D, and to the east in Alternative B.

The noise sources associated with commercial development in Alternative D would include parking lot movements, HVAC equipment, and the wastewater treatment plant. The impacts of those activities for Alternative D would be the essentially the same as those for Alternatives A and C.

The amphitheatre associated with Alternative E would be located about ½ mile from the nearest residence. The structure would be oriented so that the sound system loudspeakers would be aimed towards Lakeville Highway, in the general direction of the residence. Assuming that a sound system for a loud concert would be adjusted to produce 90 to 95 dBA at the mixing booth, as is common, the projected sound level at the nearest residence would be about 67 to 72 dBA. Since the sound system would be projecting music and voice, the resulting sound levels would exceed normally acceptable limits, and would be significant.

Noise Mitigation Measures

Under the all future traffic conditions, the 65 dB L_{dn} traffic noise contour would include noise sensitive land uses located along all of the roadways selected for this analysis. This is a significant and unavoidable impact.

The project-related increase in future noise levels from traffic on Wilfred Avenue would be significant for Alternatives A, B and C. For existing residences located adjacent to that roadway, noise levels could be reduced by providing noise barriers along the edge of the right-of-way so that the houses and outdoor activity areas are shielded by the barriers. In some cases, the barrier design would be compromised by gaps to allow driveways to existing homes. To reduce project-related traffic noise levels to below predicted future noise levels without the project, the barrier insertion loss would have to be at least 4 dB. This could practically be attained with a 6-foot high noise barrier. The barrier material would have to be solid and massive, with no significant gaps in construction.

The project-related increase in future noise levels from traffic on Lakeville Highway would be significant for Alternative E. For existing residences located adjacent to that roadway, noise levels could be reduced by providing noise barriers along the edge of the right-of-way so that the houses and outdoor activity areas are shielded by the barriers. To reduce traffic noise levels to below future noise levels without the project, the barrier insertion loss would have to be at least 2.5 dB. This could practically be attained with a 6-foot high noise barrier. The barrier material should be solid and massive, with no significant gaps in construction.

If traffic noise barriers were found to be infeasible, additional sound insulation could be provided to reduce noise levels *inside* the affected residences. For older homes, such as those near the project sites, a 5 decibel improvement in the traffic noise level reduction of the building facades exposed to traffic noise could be attained by installing acoustically-rated windows, and by ensuring that all exterior doors are of solid construction with adequate weather-stripping.

Noise from HVAC fans, the wastewater treatment plan, the central plant building, and other mechanical equipment could be mitigated to insignificant levels by requiring that all such equipment installations be designed to ensure compliance with hourly average or median noise standards of 50 dBA (daytime) and 45 dBA (nighttime).

Noise due to idling tour buses could be mitigated to an insignificant level by requiring that buses be parked as far as practical from the nearest residences, and by prohibiting excessive idling.

Potential noise impacts from loading dock operations could be mitigated by requiring that loading dock use be limited to daytime hours (7 a.m. to 7 p.m.).

The noise impacts of the amphitheatre at the Alternative E site could be mitigated by requiring compliance with a nighttime average or median hourly noise standard of 45 dBA. As a practical matter, the noise levels produced by loudspeakers as received at the nearest residence could be adjusted by reducing the sound level in the amphitheatre, by using directional speakers, and by orienting the speakers towards the audience to avoid sound propagation in the direction of the residence.

Construction noise effects could be minimized by requiring that all powered equipment comply with applicable local, state and federal regulations, and that all such equipment shall be fitted with adequate mufflers according to the manufacturer's specifications.

APPENDIX A

ACOUSTICAL TERMINOLOGY

AMBIENT NOISE LEVEL: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

CNEL: Community Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.

DECIBEL, dB: A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

DNL/L_{dn}: Day/Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.

L_{eq}: Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.

NOTE: The CNEL and DNL represent daily levels of noise exposure averaged on an annual basis, while L_{eq} represents the average noise exposure for a shorter time period, typically one hour.

L_{max}: The maximum noise level recorded during a noise event.

L_n: The sound level exceeded "n" percent of the time during a sample interval (L_{90}, L_{50}, L_{10}, etc.). For example, L_{10} equals the level exceeded 10 percent of the time.

ACOUSTICAL TERMINOLOGY

NOISE EXPOSURE CONTOURS: Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and DNL contours are frequently utilized to describe community exposure to noise.

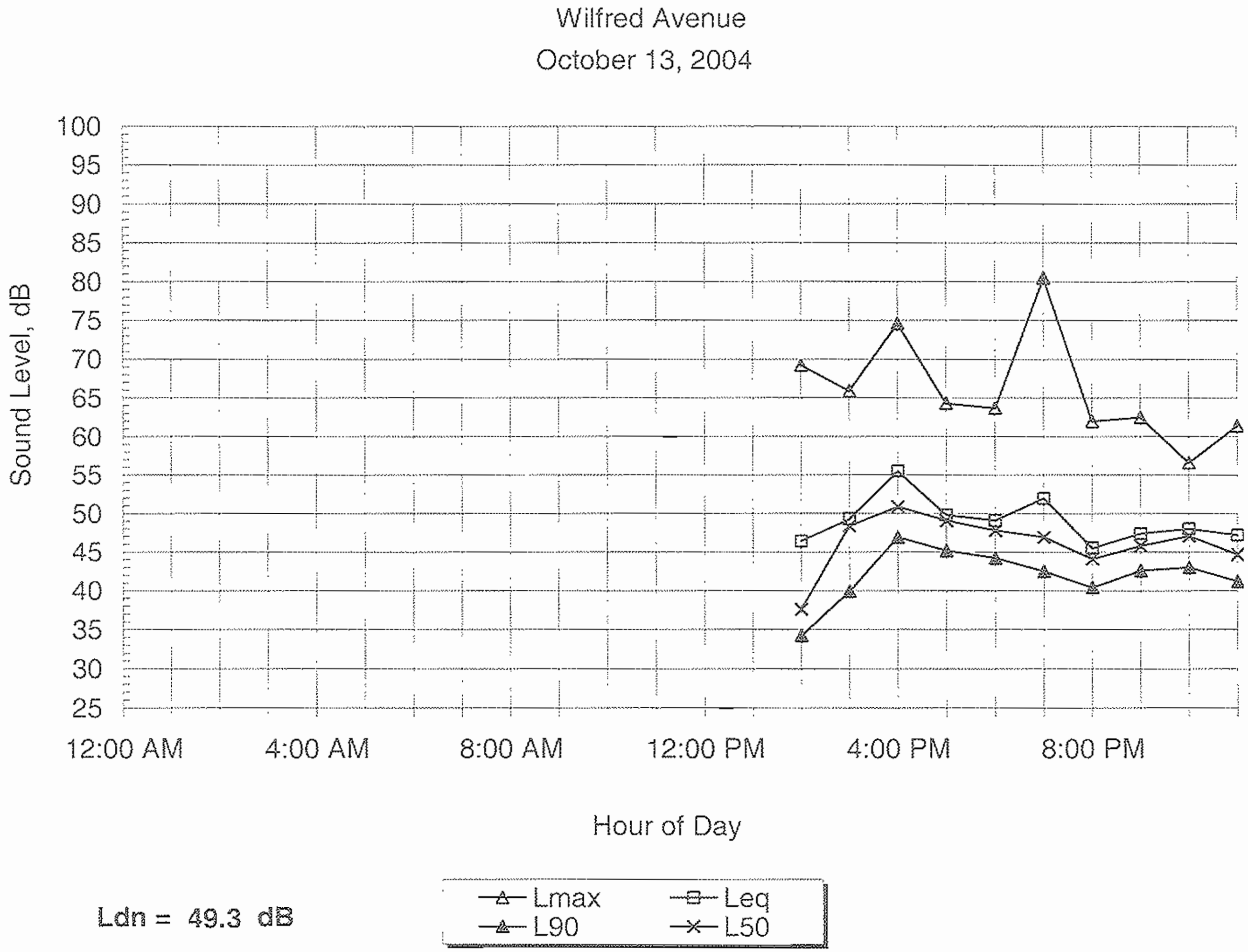
NOISE LEVEL REDUCTION (NLR): The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of Anoise level reduction@ combines the effect of the transmission loss performance of the structure plus the effect of acoustic absorption present in the receiving room.

SEL or SENEL: Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

SOUND LEVEL: The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

SOUND TRANSMISSION CLASS (STC): The single-number rating of sound transmission loss for a construction element (window, door, etc.) over a frequency range where speech intelligibility largely occurs.

Appendix B-1: Measured Hourly Noise Levels

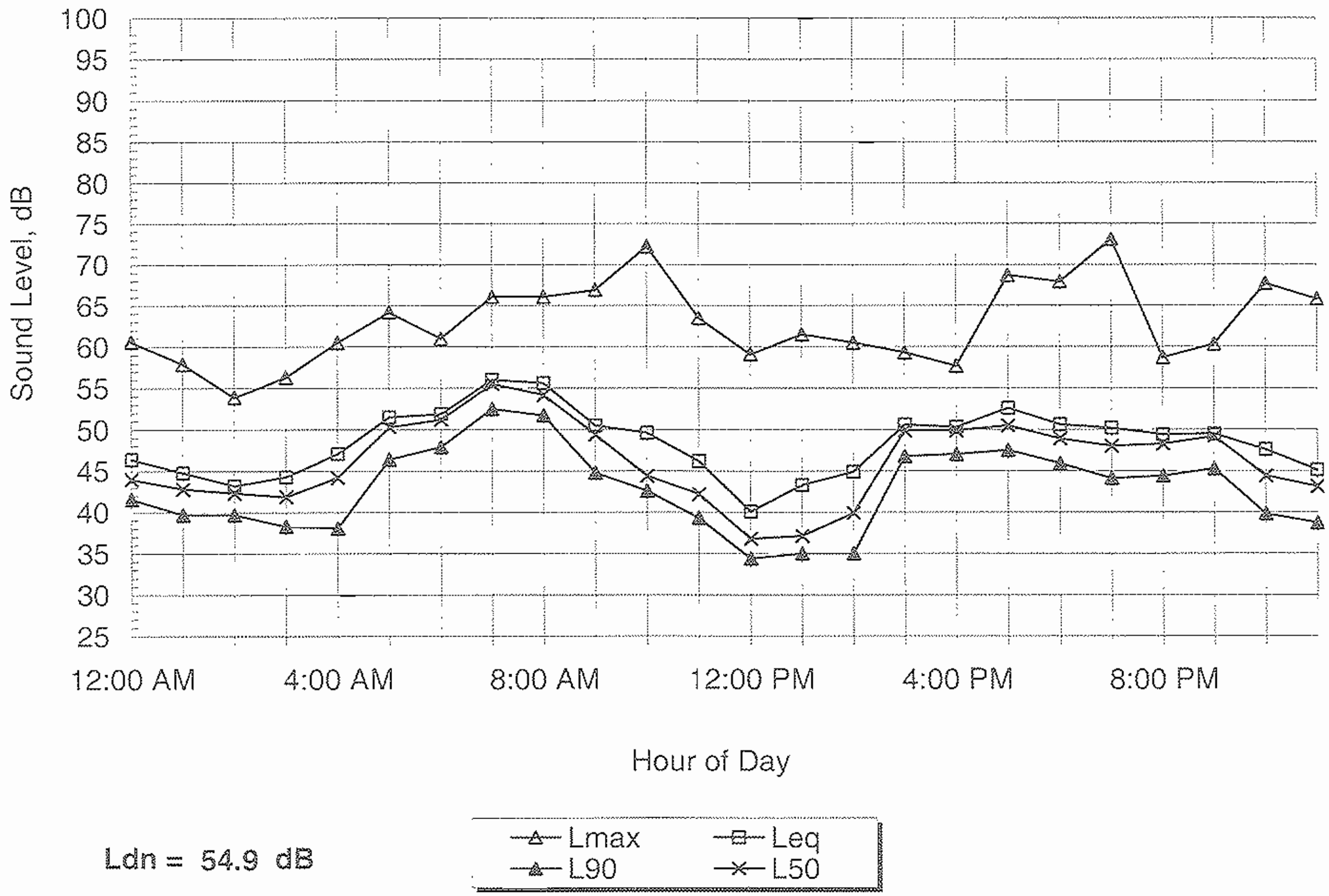


Ldn = 49.3 dB

Appendix B-2: Measured Hourly Noise Levels

Wilfred Avenue

October 14, 2004

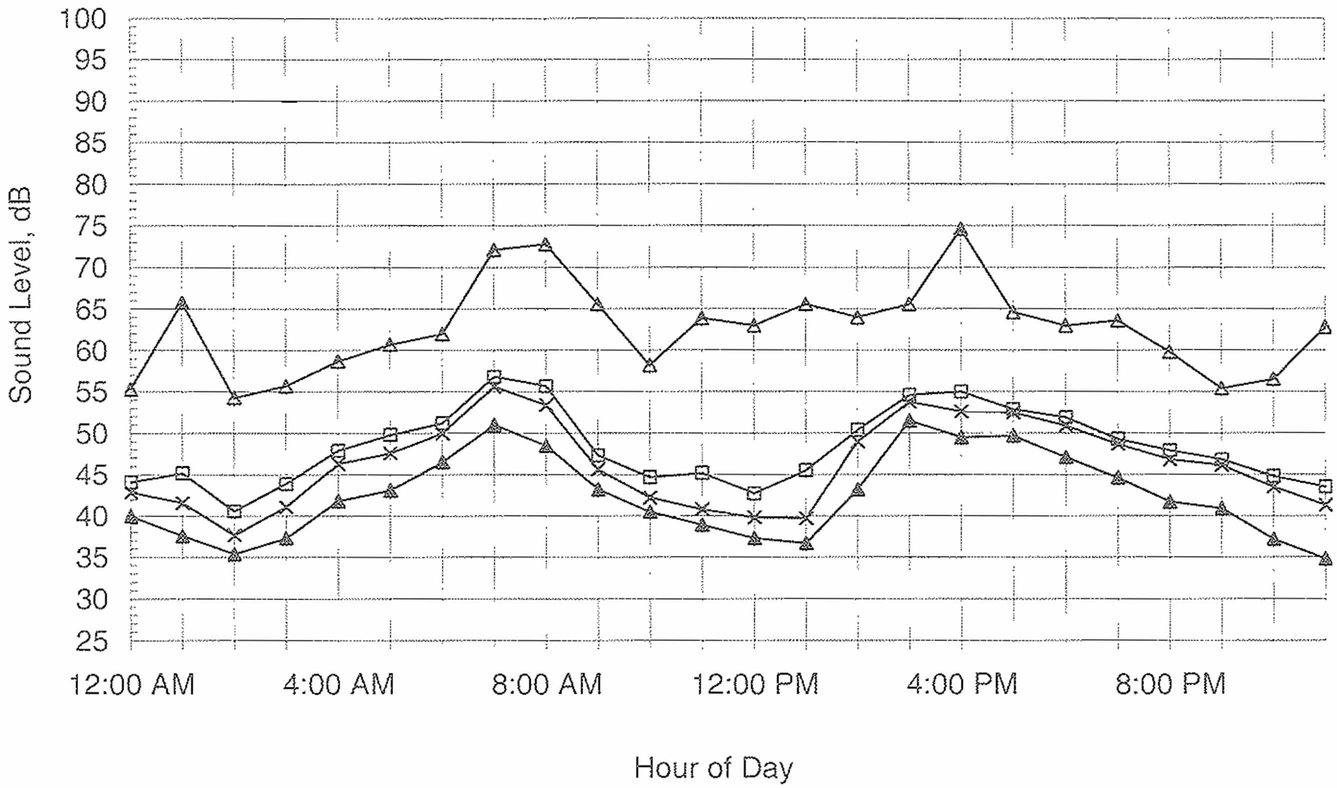


Ldn = 54.9 dB

Appendix B-3: Measured Hourly Noise Levels

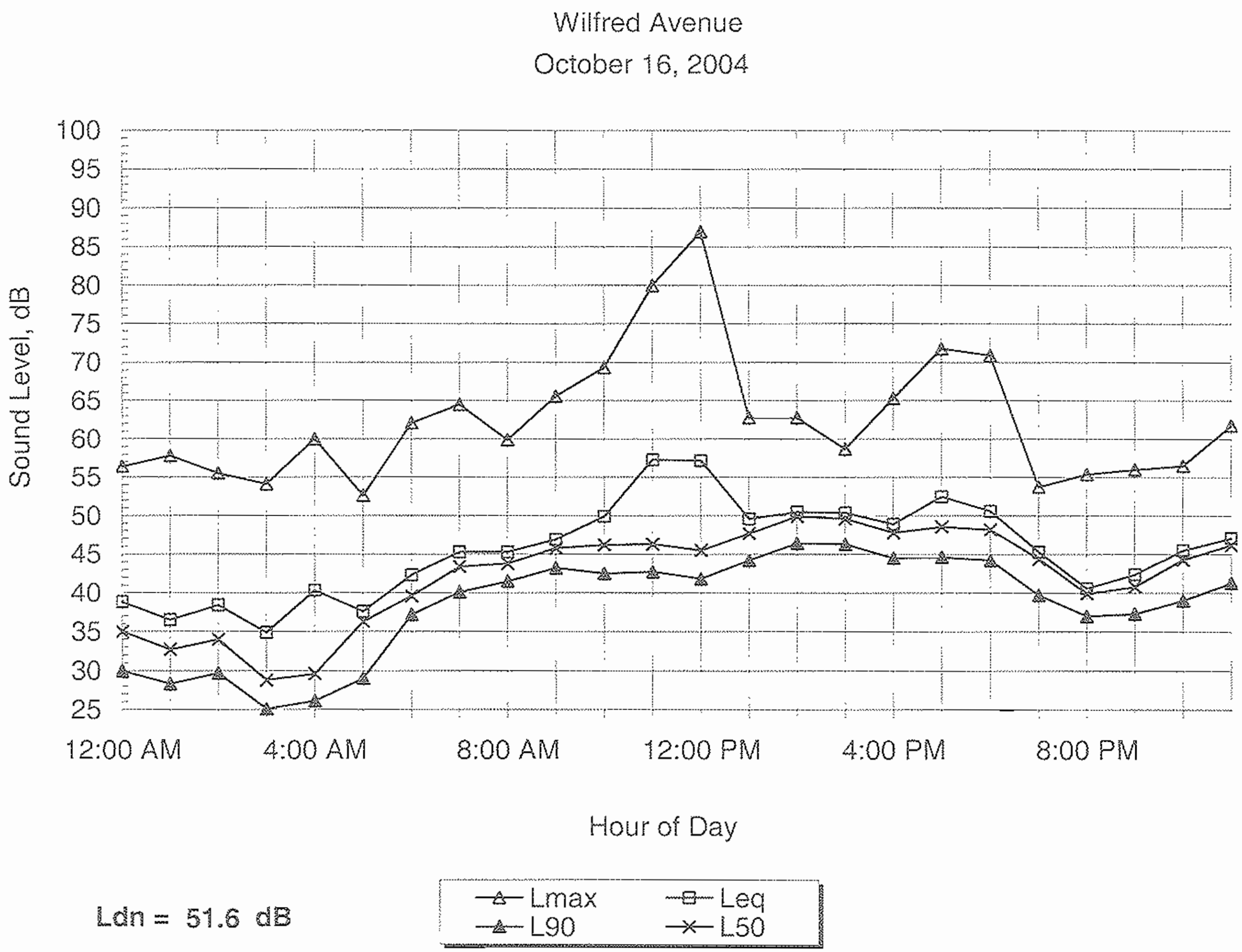
Wilfred Avenue

October 15, 2004



Ldn = 54.4 dB

Appendix B-4: Measured Hourly Noise Levels

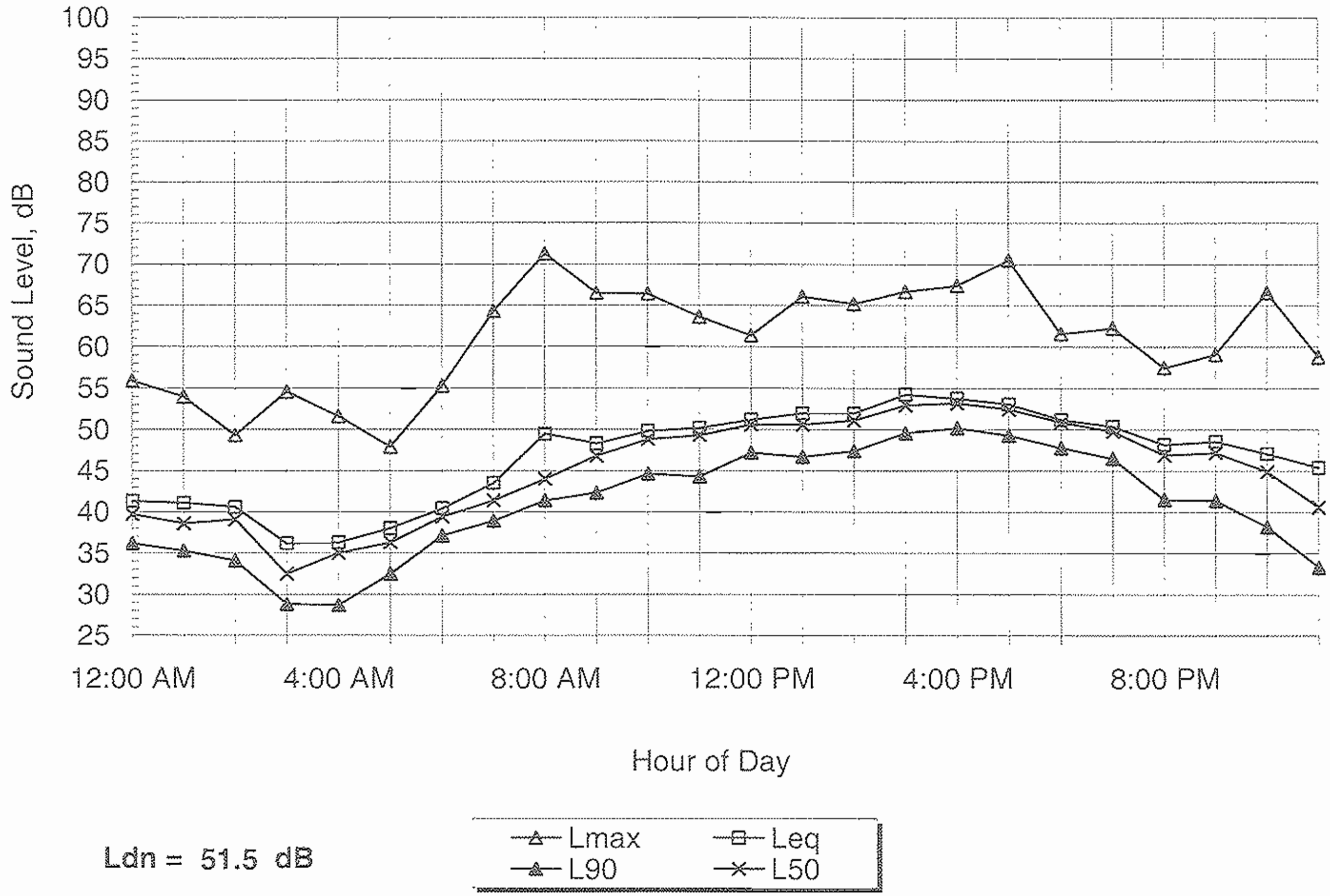


Ldn = 51.6 dB

Appendix B-5: Measured Hourly Noise Levels

Wilfred Avenue

October 17, 2004

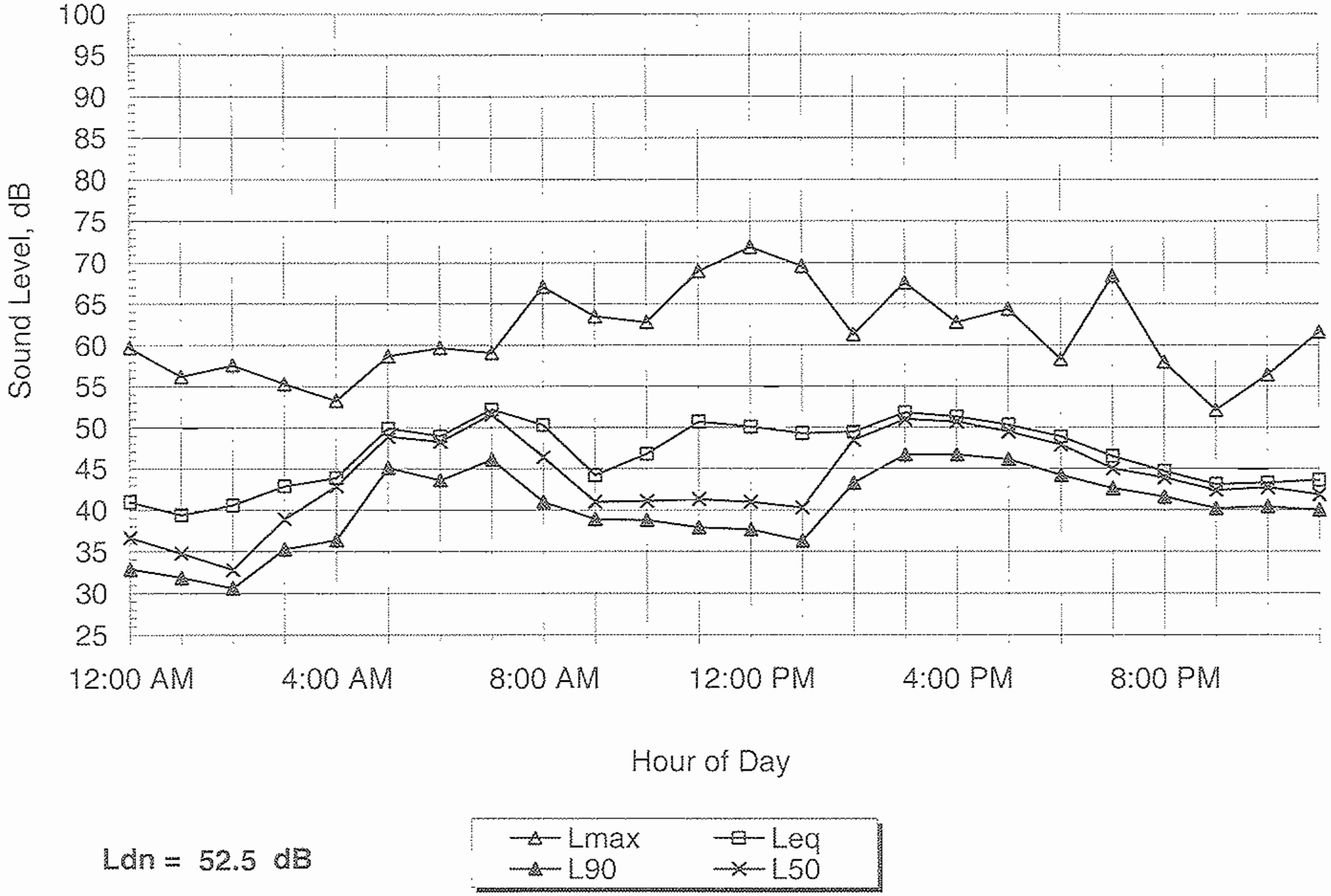


Ldn = 51.5 dB

Appendix B-6: Measured Hourly Noise Levels

Wilfred Avenue

October 18, 2004

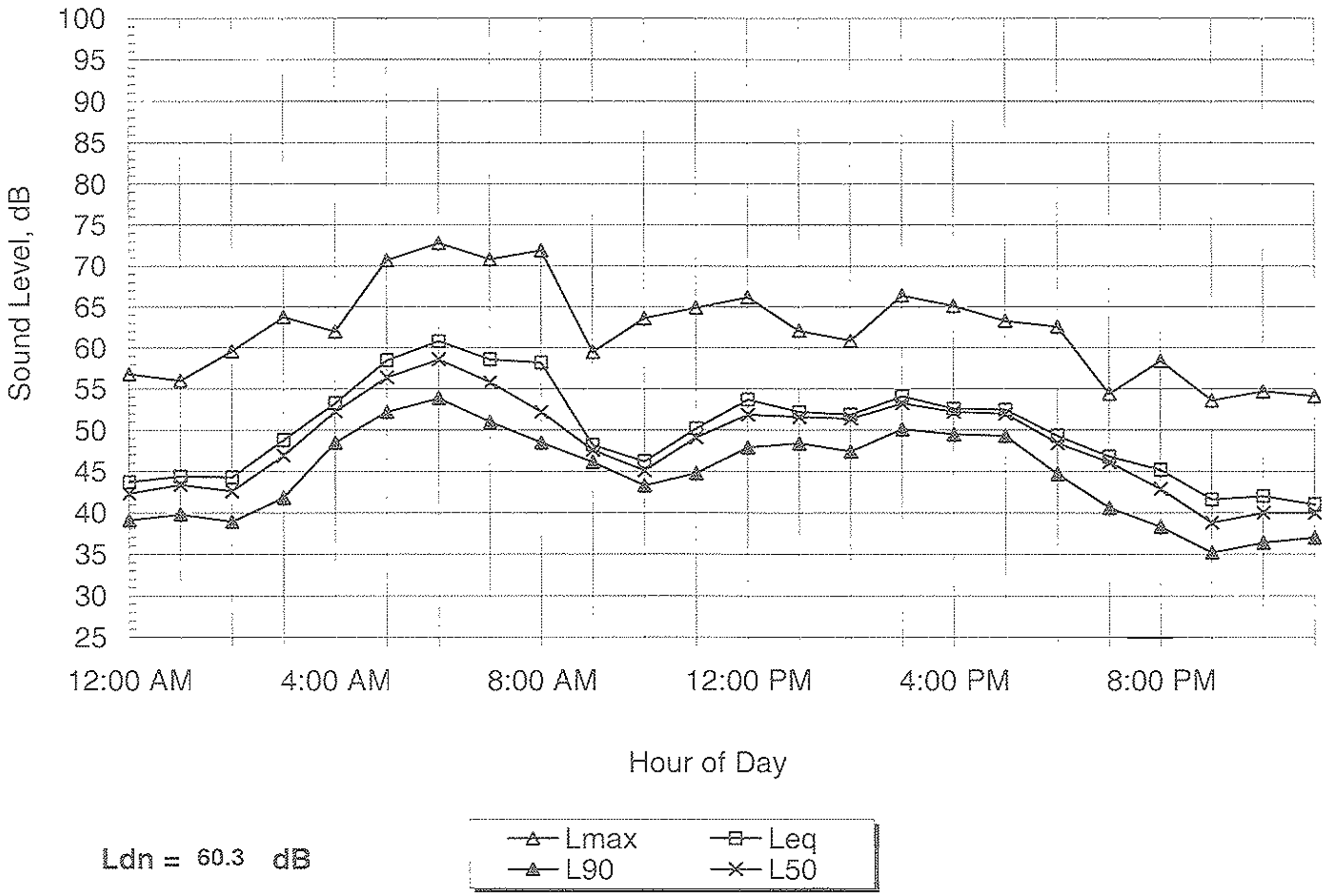


Ldn = 52.5 dB

Appendix B-7: Measured Hourly Noise Levels

Wilfred Avenue

October 19, 2004

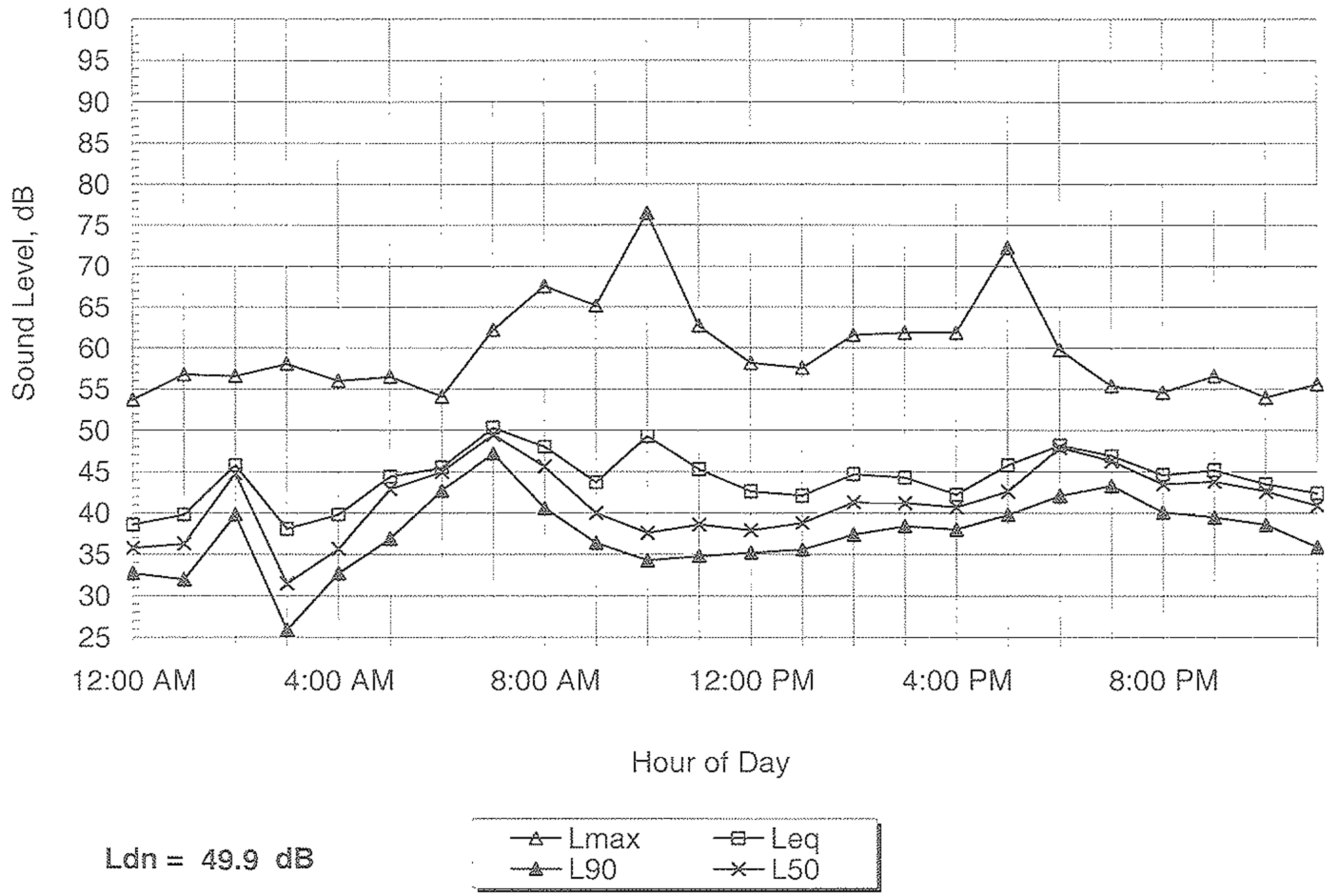


Ldn = 60.3 dB

Appendix B-8: Measured Hourly Noise Levels

Wilfred Avenue

October 20, 2004

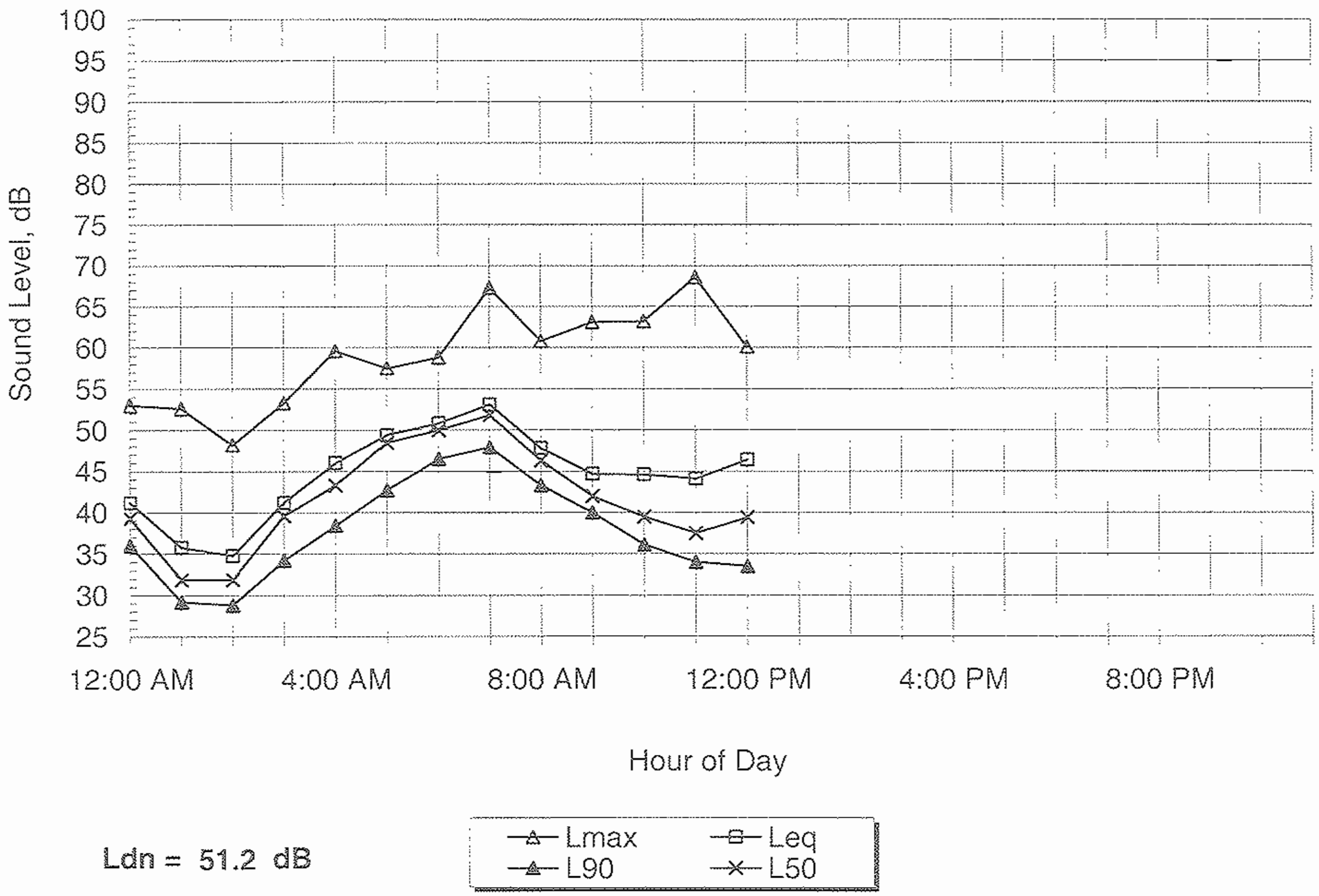


Ldn = 49.9 dB

Appendix B-9: Measured Hourly Noise Levels

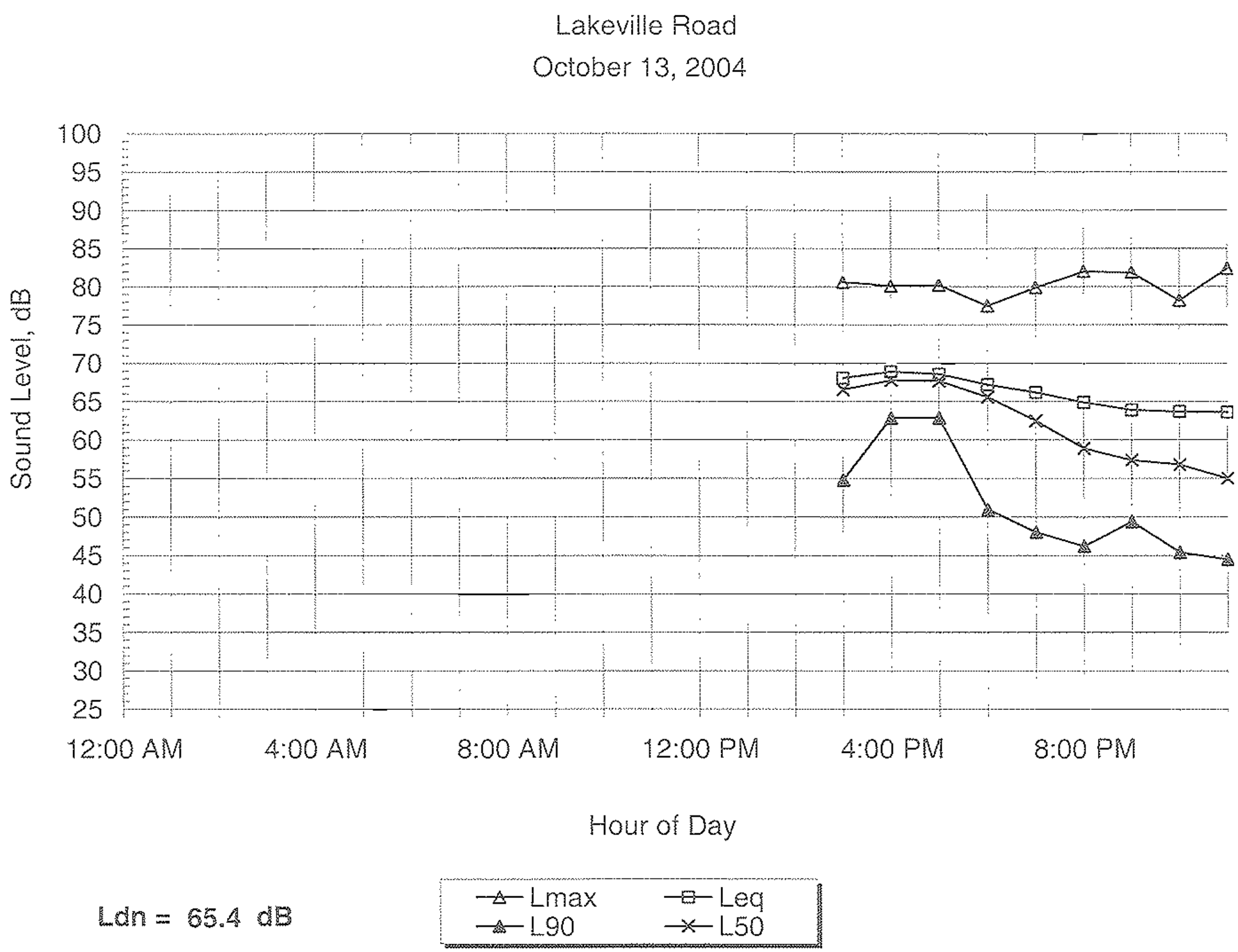
Wilfred Avenue

October 21, 2004



Ldn = 51.2 dB

Appendix B-10: Measured Hourly Noise Levels

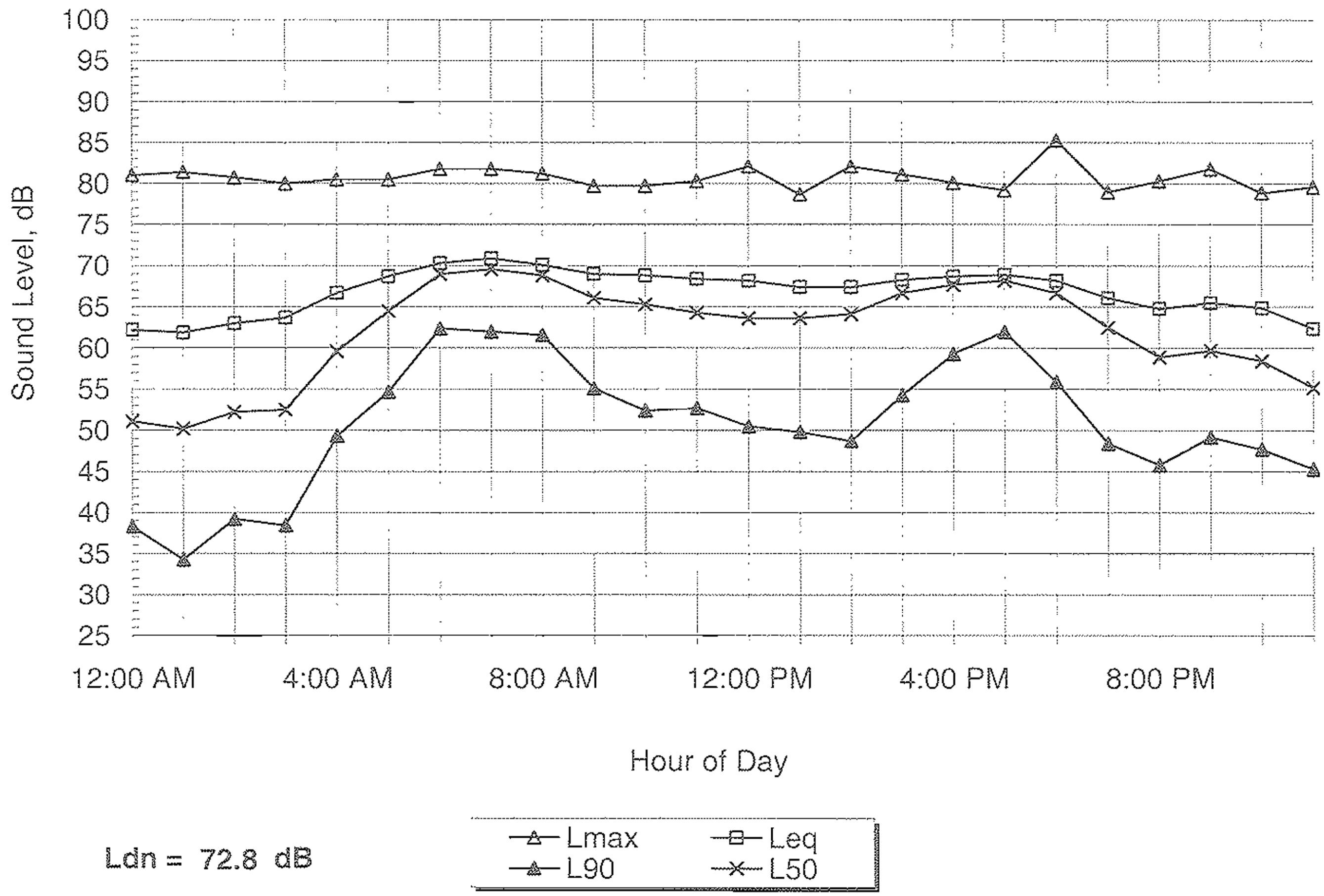


Ldn = 65.4 dB

Appendix B-11: Measured Hourly Noise Levels

Lakeville Road

October 14, 2004

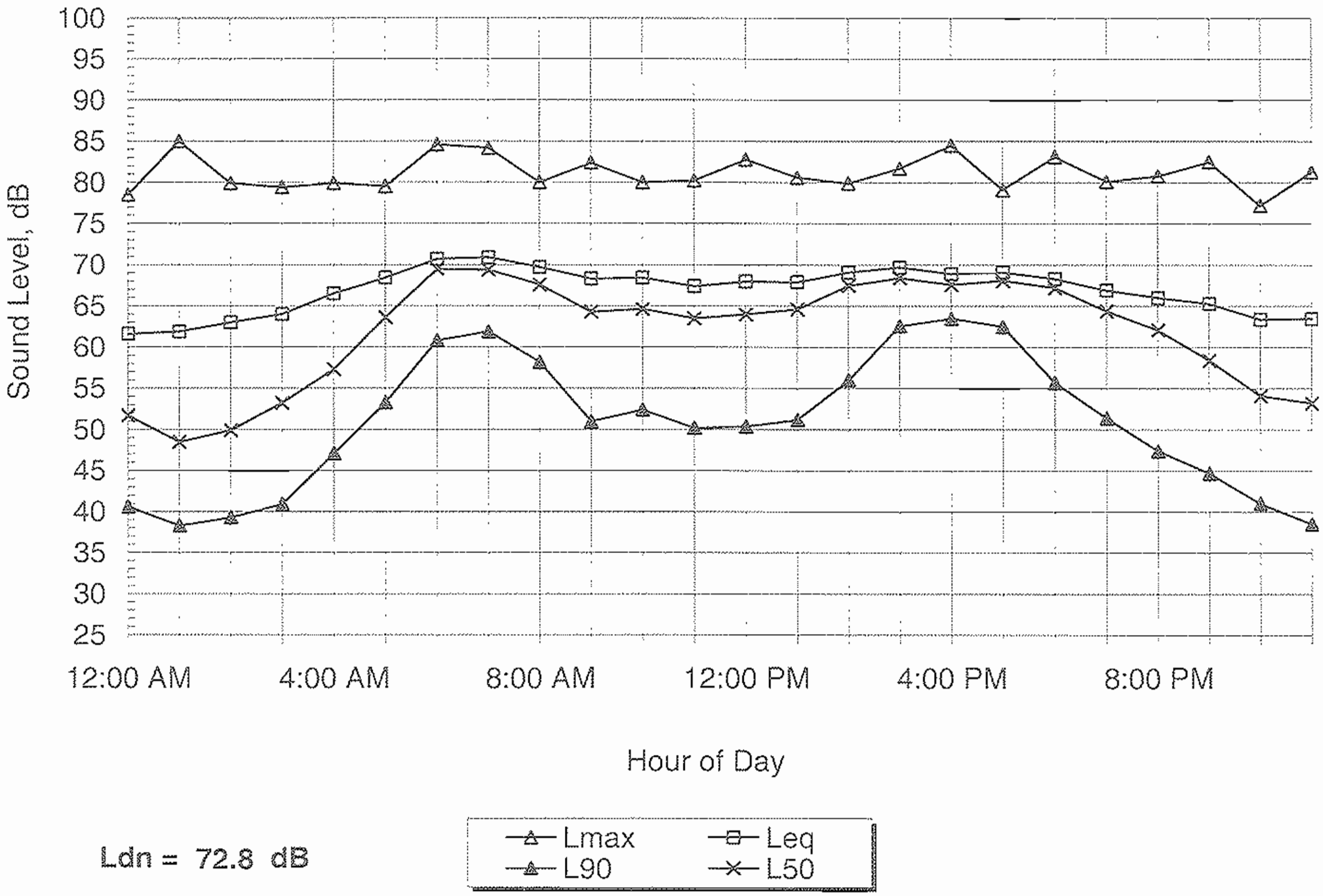


Ldn = 72.8 dB

Appendix B-12: Measured Hourly Noise Levels

Lakeville Road

October 15, 2004

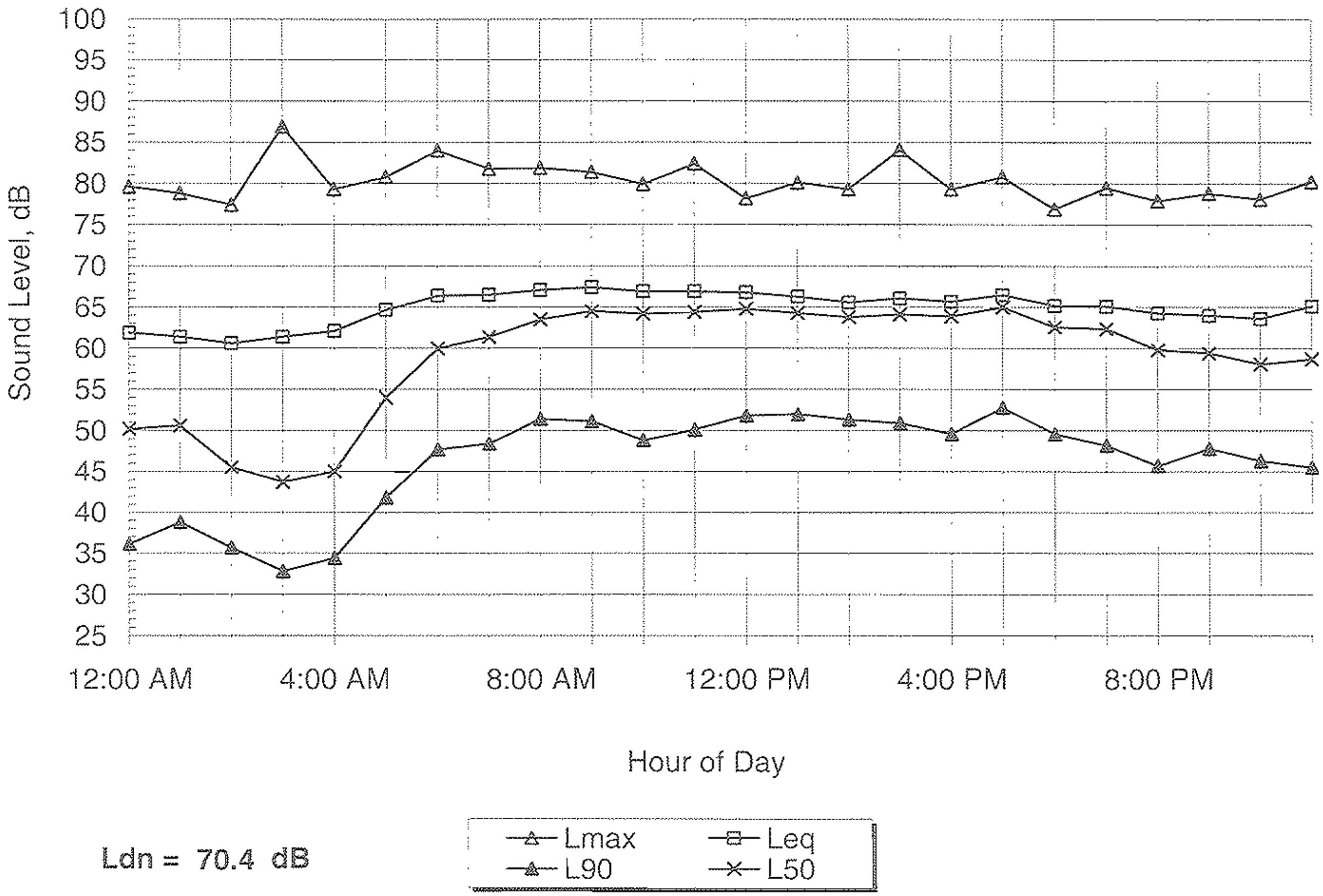


Ldn = 72.8 dB

Appendix B-13: Measured Hourly Noise Levels

Lakeville Road

October 16, 2004

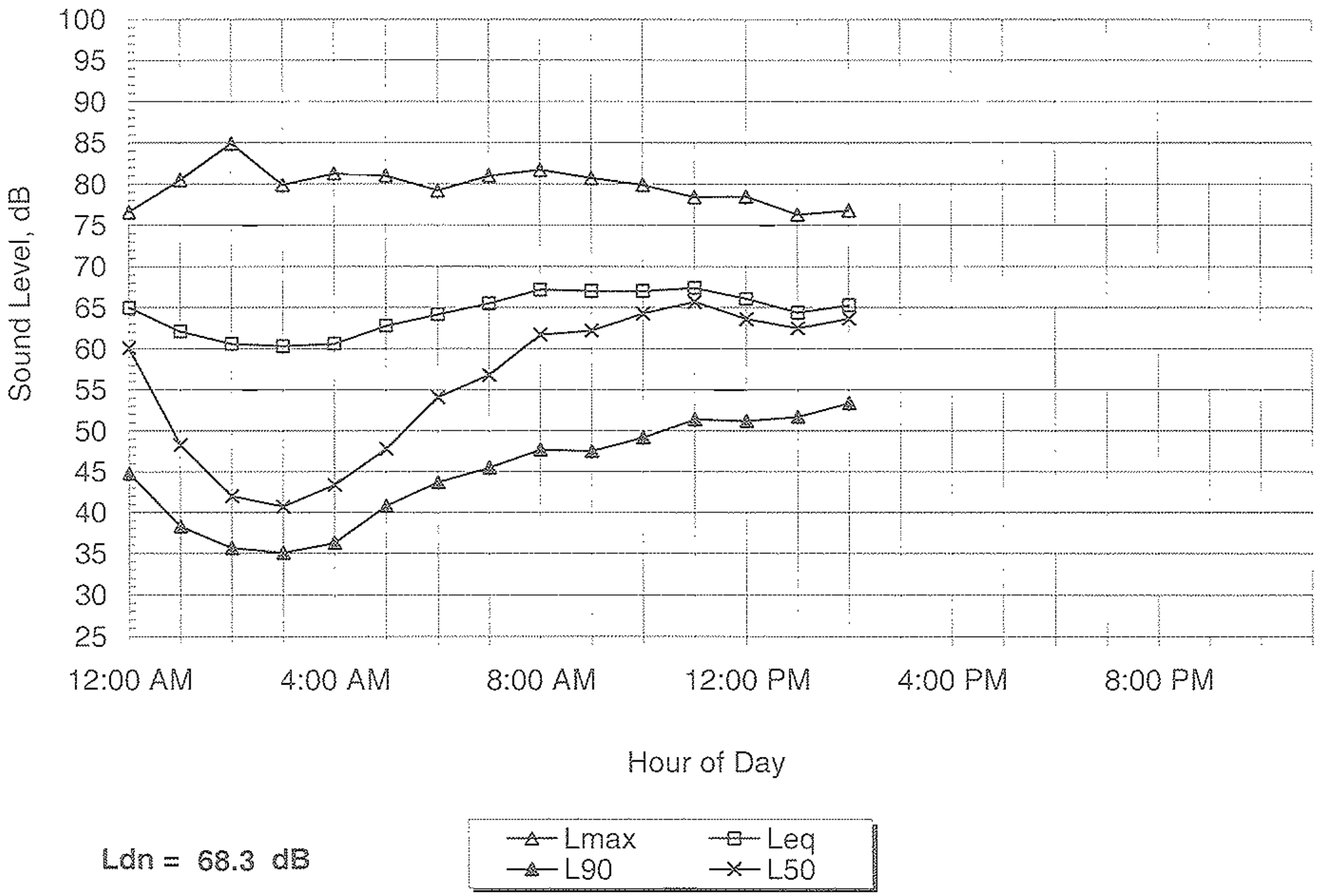


Ldn = 70.4 dB

Appendix B-14: Measured Hourly Noise Levels

Lakeville Road

October 17, 2004



Ldn = 68.3 dB

ENVIRONMENTAL NOISE ANALYSIS

GRATON RANCHERIA CASINO

Sonoma County, California

BBA Project No. 04-244B
AES Project No. 203523

Prepared For

Analytical Environmental Services
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Revised
January 2, 2007

Prepared By

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BBA
BROWN · BUNTIN ASSOCIATES INC

INTRODUCTION

Brown-Buntin Associates, Inc. (BBA) has previously prepared an Environmental Noise Analysis of the Graton Rancheria project, dated January 5, 2006. The purpose of this addendum analysis in January 2007 is to address the effects of changes made to the traffic volume study by Kimley-Horn & Associates in December 2006. The revised text provides a brief introduction to the traffic noise modeling process, then focuses on the changes to predicted noise levels and conclusions resulting from the revised traffic analysis. No changes are required for any other portions of the BBA report dated January 5, 2006.

Roadway Traffic Noise Analysis

The traffic noise study was prepared using a combination of noise measurements and traffic noise modeling. The traffic noise measurements performed near the project site were used to calibrate the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) for traffic on the nearest roadways. In addition, the ambient noise measurement data were used to derive the average day-night traffic noise distribution factor for traffic noise modeling in terms of L_{dn}.

The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA RD-77-108) was employed for the prediction of traffic noise levels. The FHWA model is the analytical method that has been traditionally favored for traffic noise prediction by most state and local agencies. It has been applied to federal and state roadway projects by the California Department of Transportation (Caltrans). The model is based upon the CALVENO noise emission factors for automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site.

The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions, and is considered to be accurate within 1.5 dB. To predict L_{dn} values, it is necessary to determine the day/night distribution of traffic and to adjust the traffic volume input data to yield an equivalent hourly traffic volume.

For the traffic noise impact analysis, it was assumed that worst-case noise exposures would occur at reference distances of 50 feet from the centerlines of the roadways.

Based upon the revised traffic volume analysis prepared for this project in December 2006 by Kimley-Horn & Associates, Inc., the FHWA model was run with the speed, truck mix, day/night distribution, and calibration offset assumptions used in the January 5, 2006 analysis to predict existing and future traffic noise levels for the roadways included in the traffic analysis. Table I lists the revised FHWA model traffic volume input assumptions.

TABLE I REVISED TRAFFIC VOLUME ASSUMPTIONS FOR NOISE MODELING									
Roadway	Segment	Existing	Future Baseline	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Rohnert Park Expressway	Labath to Stony Point	10650	9280	11840	13540	11880	12320	10450	9280
Stony Point Road	Rohnert Park Expressway to Wilfred	15050	14290	16450	20810	19100	18810	16080	14290
Redwood Drive	Rohnert Park Expressway to Wilfred Avenue	13960	16800	17220	17360	17360	15830	17400	16800
Commerce	Rohnert Park Expressway to Golf Course	11720	14050	15510	14050	14050	14050	14050	14050
Wilfred	Stony Point to Whistler	2250	4880	7500	7830	11650	6920	6200	4880
Wilfred	Whistler to Labath	1080	4880	7210	18920	11650	14580	8690	4880
Wilfred	Labath to Dowdell	910	12970	21390	26810	28850	22770	16880	12970
Wilfred	Dowdell to Redwood	1050	22860	26510	36810	38540	32470	26580	22860
Wilfred	Redwood to SR101	10540	27040	38420	40850	42790	36580	30780	27040
Business Park	Labath to Redwood	2150	2120	2740	2120	2120	2120	2120	2120
Roberts Lake	Commerce to Golf Course	5240	4060	4650	4060	4060	4060	4060	4060
Millbrae	Stony Point to Primrose	2210	4290	4210	4510	4610	4440	4390	2210
SR 37	At Lakeville Highway	36220	43300	43300	43300	43300	43300	43300	52240
SR 37	At SR 121	27660	35340	35340	35340	35340	35340	35340	44490
Lakeville Highway	At SR 37	5250	28850	28850	28850	28850	28850	28850	51720
SR 121	At SR 37	17130	21190	21190	21190	21190	21190	21190	22340

Table II shows the predicted traffic noise levels for future conditions on each roadway for each scenario, at the reference distance of 50 feet from the roadway centerline.

TABLE II
PREDICTED TRAFFIC NOISE LEVELS AT REFERENCE DISTANCE (REVISED)

Roadway	Segment	Predicted L_{dn}, dB							
		Existing	Future Baseline	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Rohnert Park Expressway	Labath to Stony Point	70.1	69.5	70.5	71.1	70.5	70.7	70.0	69.5
Stony Point Road	Rohnert Park Expressway to Wilfred	73.3	73.1	73.7	74.8	74.4	74.3	73.6	73.1
Redwood Drive	Rohnert Park Expressway to Wilfred Avenue	66.5	67.4	67.5	67.5	67.5	67.1	67.5	67.4
Commerce	Rohnert Park Expressway to Golf Course	64.5	65.2	65.7	65.2	65.2	65.2	65.2	65.2
Wilfred	Stony Point to Whistler	59.8	63.2	65.1	65.3	67.0	64.7	64.2	63.2
Wilfred	Whistler to Labath	56.7	63.2	64.9	69.1	67.0	68.0	65.7	63.2
Wilfred	Labath to Dowdell	55.9	67.5	69.6	70.6	70.9	69.9	68.6	67.5
Wilfred	Dowdell to Redwood	56.5	69.9	70.6	72.0	72.2	71.4	70.6	69.9
Wilfred	Redwood to SR101	66.6	70.6	72.2	72.4	72.6	72.0	71.2	70.6
Business Park	Labath to Redwood	59.6	59.6	60.7	59.6	59.6	59.6	59.6	59.6
Roberts Lake	Commerce to Golf Course	63.5	62.4	63.0	62.4	62.4	62.4	62.4	62.4
Millbrae	Stony Point to Primrose	59.8	62.6	62.6	62.9	63.0	62.8	62.7	62.6
SR 37	At Lakeville Highway	77.9	78.7	78.7	78.7	78.7	78.7	78.7	79.5
SR 37	At SR 121	75.2	76.3	76.3	76.3	76.3	76.3	76.3	77.3
Lakeville Highway	At SR 37	70.1	77.5	77.5	77.5	77.5	77.5	77.5	80.0
SR 121	At SR 37	72.2	73.1	73.1	73.1	73.1	73.1	73.1	73.3

Table III shows the predicted changes in traffic noise levels, as compared to existing or future cumulative conditions

TABLE III CHANGES IN PREDICTED TRAFFIC NOISE LEVELS AT REFERENCE DISTANCES (REVISED)								
Roadway	Segments	Predicted L_{dn}, dB						
		Future Baseline minus Existing	Alt. A minus Future Baseline	Alt. B minus Future Baseline	Alt. C minus Future Baseline	Alt. D minus Future Baseline	Alt. E minus Future Baseline	Alt. F minus Future Baseline
Rohnert Park Expressway	Labath to Stony Point	-0.6	1.1	1.6	1.1	1.2	0.5	0
Stony Point Road	Rohnert Park Expressway to Wilfred	-0.2	0.6	1.6	1.3	1.2	0.5	0
Redwood Drive	Rohnert Park Expressway to Wilfred Avenue	0.8	0.1	0.1	0.1	-0.3	0.2	0
Commerce	Rohnert Park Expressway to Golf Course	0.8	0.4	0.0	0.0	0.0	0.0	0
Wilfred	Stony Point to Whistler	3.4	1.9	2.1	3.8	1.5	1.0	0
Wilfred	Whistler to Labath	6.5	1.7	5.9	3.8	4.8	2.5	0
Wilfred	Labath to Dowdell	11.5	2.2	3.2	3.5	2.4	1.1	0
Wilfred	Dowdell to Redwood	13.4	0.6	2.1	2.3	1.5	0.7	0
Wilfred	Redwood to SR101	4.1	1.5	1.8	2.0	1.3	0.6	0
Business Park	Labath to Redwood	-0.1	1.1	0.0	0.0	0.0	0.0	0
Roberts Lake	Commerce to Golf Course	-1.1	0.6	0.0	0.0	0.0	0.0	0
Millbrae	Stony Point to Primrose	2.9	-0.1	0.2	0.3	0.1	0.1	0
SR 37	At Lakeville Highway	0.8	0	0	0	0	0	0.8
SR 37	At SR 121	1.1	0	0	0	0	0	1
Lakeville Highway	At SR 37	7.4	0	0	0	0	0	2.5
SR 121	At SR 37	0.9	0	0	0	0	0	0.2
Note: Shaded cells indicate a potentially significant increase in noise levels.								

Table II shows that noise levels associated with cumulative future traffic (without the Project) would exceed the 65 dB L_{dn} land use compatibility criterion if noise sensitive development were present or proposed immediately adjacent to all of the roadways listed above, except for the portion of Wilfred Avenue between Stony Point and Labath, Roberts Lake north of Golf Course, and Millbrae east of Stony Point. This condition would occur with or without the project.

Table II also shows that, for Alternatives A-E, noise levels associated with future traffic would also approach or exceed the 65 dB L_{dn} land use compatibility criterion if noise sensitive development were present or proposed immediately adjacent to the portion of Wilfred Avenue between Stony Point and Labath. This would be a significant project-related impact.

Based upon Table III, traffic noise levels along Rohnert Park Expressway and Stony Point Road would increase by up to 1.6 dB with Alternative B as compared to the future baseline condition. Traffic noise levels along Wilfred Avenue would increase by 1.5 to 5.9 dB with Alternatives A-E as compared to the future baseline condition. Using the FICON criteria, the predicted changes in traffic noise levels with the indicated alternatives would be significant for the noise sensitive receivers located along those roadways. This would be a significant noise impact.

In Alternative F, traffic noise levels along Lakeville Highway would increase by 2.5 dB as compared to the future baseline condition. Using the FICON criteria, the predicted change in traffic noise levels on that roadway would be significant for the noise sensitive receivers located along that roadway. This would be a significant noise impact.

Traffic Noise Mitigation Measures

Under all future traffic conditions, the 65 dB L_{dn} traffic noise contour would include noise sensitive land uses located along all of the roadways selected for this analysis, except for the portion of Wilfred Avenue between Stony Point and Labath, Roberts Lake north of Golf Course, and Millbrae east of Stony Point.. This is a significant and unavoidable impact.

The project-related increase in future noise levels from traffic on Wilfred Avenue would be significant for Alternatives A-E.

Suitable mitigation measures for traffic noise include the use of setbacks, noise barriers, and acoustical treatment of building facades.

Setbacks

Setbacks would not be feasible as mitigation for existing residences, since the homes cannot practically be moved farther away from the roadways.

Barriers

For existing residences located adjacent to Wilfred Avenue, noise levels could be reduced by providing noise barriers along the edge of the right-of-way so that the houses and outdoor activity areas are shielded by the barriers. In some cases, the barrier design would be compromised by gaps to allow driveways to existing homes. To reduce project-related traffic noise levels to below future noise levels without the project, the barrier insertion loss would have to be as much as 5.9 dB. This could practically be attained with an 8-foot high noise barrier. The barrier material would have to be solid and massive, with no significant gaps in construction.

The project-related increase in future noise levels from traffic on Lakeville Highway would be significant for Alternative F. For existing residences located adjacent to that roadway, noise levels could be reduced by providing noise barriers along the edge of the right-of-way so that the houses and outdoor activity areas are shielded by the barriers. To reduce traffic noise levels to below future noise levels without the project, the barrier insertion loss would have to be at least 2.5 dB. This could practically be attained with a 6-foot high noise barrier. The barrier material should be solid and massive, with no significant gaps in construction.

The use of noise barriers is not expected to be practical to mitigate traffic noise impacts for existing residences for the following reasons:

- Barrier design would be compromised by the gaps needed to ensure safe sight lines for traffic, and by the need to provide access openings for driveways.
- In some cases, the barriers would have to be relatively long to shield individual homes on large parcels. The cost of any such barrier would likely not be reasonable given the benefit to be derived for only one residence.

Acoustical Treatment

Additional sound insulation could be provided to reduce noise levels *inside* residences affected by traffic noise. For older homes, such as those near the project sites, a 5 decibel improvement in the traffic noise level reduction of the building facades exposed to traffic noise could be attained by installing windows that are designed to provide enhanced noise attenuation, and by ensuring that all exterior doors are of solid construction with adequate weather-stripping. This degree of improvement would be clearly noticeable. Since the exterior traffic noise levels at the nearest houses are expected to be in the range of 70 dB L_{dn} or less, the expected interior noise levels after acoustical treatment would be in the range of 40 to 45 dB L_{dn}, which is considered to be acceptable. Therefore, providing acoustical treatment to houses that would have significant exterior traffic noise exposures would mitigate traffic noise inside the houses to less than significant levels.

Respectfully submitted,
Brown-Buntin Associates, Inc.

Jim Buntin
Vice President