

NOISE ANALYSIS

PROPOSED MCDONALD'S RESTAURANT

MCDONALD'S RESTAURANT

3901 EAST 22ND ST.

Tucson, Arizona

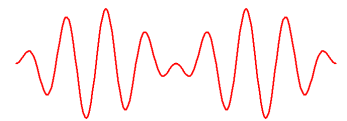
Noise Expert Project No. 14092

Prepared for



McDonald's USA

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1.0 Summary

McDonald's Restaurant is proposing to locate a new facility on the northeast corner of Alvernon Way and 22nd Street in Tucson, Arizona, as shown in Figures 1 and 2. Noise Expert was asked to perform a Noise Impact Assessment for the proposed McDonald's Restaurant to help evaluate the potential noise impacts of the Drive Thru Customer Order Display (COD), and compare them with the existing noise levels.

The predicted noise levels from the COD were 35 to 38 dBA. The Tucson City Code limits noise to 70 dBA during daytime hours and 62 dBA during nighttime hours. The predicted noise levels are well below the Tucson City Code.

In addition, the predicted noise levels are well below the existing noise levels at the closest residential properties (50 to 61 dBA).

This report presents the information developed by Noise Expert for the noise impact analysis. The information presented in the report includes a description of the proposed operation, measurement results showing the existing environment at noise sensitive properties, an evaluation of the future noise environment expected around the project site, and a discussion about the noise descriptors used in the analysis.

2.0 Overview of the Noise Impact Analysis Procedure

Noise Expert conducted a sound study to determine the noise impacts that will be associated with the proposed McDonald's restaurants Drive Thru speakers. The noise study was conducted in three steps:

1. The current ambient noise levels were measured at noise sensitive receivers (residences) in the vicinity of the proposed project.
2. Noise expected to radiate from the proposed McDonald's Restaurant Drive Thru Customer Order Display (COD) was predicted using standard acoustical formulas and reference sound levels for the proposed activities.
3. The predicted noise levels at the closest residence to the COD were compared with the relevant noise standards, and the existing noise levels.

This report presents the results of the study.

3.0 Overview of the Proposed Facility

McDonald's Restaurant is proposing to locate a facility at 3901 East 22nd St on the northeast corner of Alvernon Way and 22nd Street. in Tucson, Arizona, as shown in Figure 1.

The site is rectangular and measures approximately 310 feet east to west and 275 feet north to south, as shown in Figure 2. The existing elevation of the ground is 2,516 feet above sea level, the elevation at the adjacent residences to the north and east of the proposed facility is also 2,516 feet in elevation.

The proposed McDonald's is located in a mixed commercial-residential neighborhood. Currently, the site has a vacant building at the south side of the center of the property (previously gas station / convenient store). There is a vacant building at the northwest side of the center of the property (previously a carwash). A house at the northeast corner of the property will be demolished and will be part of the parking area for the proposed McDonald's restaurant.

To east of the proposed McDonald's site and to the north of 22nd street will be two vacant lots for sale. 3942 Camino De Palmas is a residents east of the proposed McDonald's site and to the south of Camino De Palmas. The north is bounded by Camino De Palmas with a commercial property on the north side, Alvernon Way Office Suites. The office building is located at 1037 Alvernon Way. To the east of the Alvernon Way Office Suites and still north of Camino De Palmas are residential properties. The residential property to the east of Alvernon Way Office Suites and directly north of the proposed McDonalds site is located at 3907 Camino De Palmas. The west is bounded by Alvernon Way and to the west of Alvernon Way is the Tucson Midway Police Department. The south is bounded by 22nd St and to the south of that are commercial properties including Walgreens, Taco Bell, and Jack in the Box.



Proposed McDonald's site-south



Proposed McDonald's site-north



Location 1 north of site



Location 2 east of site

The proposed McDonald's drive thru COD will operate 24-hours per day and 7 days per week. An 8-foot high wall will be located on the north and east side of the property between the restaurant and the residences closest to the proposed facility.

4.0 Noise Impact Criteria

The proposed McDonald's restaurant is located in the City of Tucson, County of Pima in the State of Arizona.

The Tucson Code (Section 16-31) states that the maximum noise allowed to radiated beyond a person's property line will be no more than 70 dBA during daytime hours (7 AM to 10 PM) and 62 dBA during nighttime hours (10 PM to 7 AM).

5.0 Sound Level Measurements

Ambient sound levels were measured to get an understanding of the existing noise levels in the vicinity of the site. This will help us determine the noise impact of the proposed site.

5.1 Measurement Procedure

Noise levels were measured using a Larson Davis 820 sound level meter that meets the American National Standard Institute (ANSI) requirements for Type 1 sound level meter. The detector of the meter was set for "slow" response. The microphone was located approximately five feet above the ground. The sound level meter was calibrated prior to and after the noise measurements were taken.

Noise was measured during four different time periods, one on Thursday, October 23, 2014 between 6 PM and 7 PM. On Friday, October 24, 2014 noise levels were measured (Midnight -1 AM, 6 AM-7 AM and Noon-1 PM)

5.2 Measurement Locations and Results

Existing ambient noise levels were measured at two locations in the vicinity of the site, as shown in Figure 1. The following information describes the measurement locations:

Location 1 On the south property line of the residence at 3907 Camino De Palmas. Approximately 50 feet north of the proposed McDonald's property line at 3901 E 22nd St. and 175 feet east of the east edge of Alvernon Way.

Location 2 On the west property line of the residence at 3926 Camino De Palmas. Approximately 90 feet south of the Camino De Palmas, and five feet to the west of the residence at 3926 Camino De Palmas. There is an existing six foot wall on the property line to the east, noise level measurements were taken just to the west of the wall.

A summary of the noise measurements is shown in Table 1.

Table 1
Measured L_{eq} Noise Level

Day	Time	Measured L_{eq} Noise Levels (dBA) at the Following Receivers	
		Location 1	Location 2
10/23/14	6-7 PM	59	59
10/24/14	Midnight-1 AM	50	53
10/24/14	6-7 AM	60	61
10/24/14	Noon-1 PM	60	59

5.3 Observations

Locations 1 and 2 were located approximately 140 feet apart. The primary noise sources at both locations were traffic on Alvernon Way and 22nd Street, and occasional aircraft.

The noise reduced to 52 dBA when there was a red light on Alvernon Way causing gaps in the traffic. The noise level reached 67-70 dBA when a loud vehicle, such as a truck or motorcycle, passed by the measurement locations. The measured noise level averaged 50 to 60 dBA depending on the time of day.

Airplanes occasionally flew in the vicinity of the site during daytime hours. The noise level increase depended on the type of aircraft and vicinity. David Monthan Air Force Base is one mile south-southeast, with the air traffic path directed over the proposed McDonalds site at 3901 East 22nd St. Tucson, Arizona. The location of the David Monthan Air Force Base caused the military planes to fly low to the ground as they were departing and landing and increased the noise levels when flying overhead. At times, aircraft caused the noise level to briefly increase to 76 dBA.

On Thursday, October 23, 2014, during the measurement starting at 6 PM, the weather was mostly sunny and clear. The temperature was approximately 82°F and the average humidity was approximately 26%. It was calm and there was a no breeze during this time.

On Friday, October 24, 2014 during the measurement at Midnight the weather was clear. The temperature was approximately 65°F and the average humidity was approximately 54%. It was calm and there was a no breeze during this time.

On Friday, October 24, 2014 during the measurements at 6 AM, the temperature was approximately 64°F and the average humidity was approximately 50%. It was calm and there was a no breeze during this time.

On Friday, October 24, 2014 during the measurements at noon, the temperature was approximately 87°F and the average humidity was approximately 26%. There was a slight breeze from the south, less than 4 mph.

6.0 Predicted Noise Levels Generated by the Proposed Project

6.1 Noise Prediction Methodology

Established acoustical formulas for outdoor sound propagation were used to predict the noise levels that will radiate from the proposed operations. The calculation accounts for sound attenuation due to distance, atmospheric conditions, barriers and vegetation.

6.2 Reference Noise Levels

Product noise data supplied by McDonalds shows the noise from the COD is 60 dBA at 16 feet. Noise Expert measured the noise levels from several existing CODs at existing McDonalds. It was observed that the noise from the idling car next to the COD blocked some of the loud speaker noise and the idling vehicle was the primary noise source. At 20 feet from the COD and the idling vehicle, the measured noise level was 59 to 61 dBA. The amount from the COD alone was calculated to be 54 to 57 dBA, at 20 feet.

6.3 Prediction Locations

Project generated noise levels were predicted at the residences north and east of the proposed site, shown in Figures 1 and 2.

Location1 On the south property line of the residence at 3907 Camino De Palmas. Approximately 50 feet north of the proposed McDonald's property line at 3901 E 22nd St. and 175 feet east of the east edge of Alvernon Way.

Location 3 At the east property line of the Proposed McDonalds close to the residence at 3942 Camino De Palmas. Approximately 90 feet south of the Camino De Palmas, and 315 feet to the east of 22nd St. (Location 3 is predicted measurements)

6.4 Assumptions Used in Predicting Project Generated Noise Levels

The noise predicted to radiate from the proposed McDonald's drive thru COD does not represent the noise that will be produced constantly during all hours. Instead, the scenario models the loudest noise that could be anticipated to radiate the COD to the surrounding residences. To insure the worst case levels are predicted, the model included all of the following assumptions:

- *80% humidity and 80°F were assumed.* The noise level at the receivers will be slightly lower, if the humidity is lower or if the temperature is higher.
- Noise reduction from the 8' high wall was considered. The wall will also reduce parking activity noise.

6.5 Prediction Results

The loudest hourly L_{eq} noise levels that could radiate from the proposed McDonald's drive thru COD were predicted to the nearest residence to the north and east, shown in Figure 2. The predicted noise levels are from the proposed drive thru COD and idling cars at the COD.

Table 2
Predicted Loudest L_{eq} Noise Levels and Existing Noise Levels during Various Times of Day at the Closest Residence to the North and East

Location	Time Period	Predicted L_{eq} Noise Levels (dBA)	Existing Measured L_{eq} Noise Levels (dBA)
1 - North	Evening	38	59
	Late Night		50
	Morning		60
	Mid-day		60
3 - East	Evening	35	59
	Late Night		53
	Morning		61
	Mid-day		59

As shown in Table 2, the predicted noise levels from the proposed drive thru COD is well below the existing measured noise levels at the closest residences to the north and to the east. In addition, the predicted noise levels are well below the Tucson City Code noise limits.

7.0 Acoustic Terminology

Sound Pressure Level

Sound, or noise, is the term given to variations in air pressure that are capable of being detected by the human ear. Small fluctuations in atmospheric pressure (sound pressure) constitute the physical property measured with a sound pressure level meter. Because the human ear can detect variations in atmospheric pressure over such a large range of magnitudes, sound pressure is expressed on a logarithmic scale in units called decibels (dB). Noise is defined as “unwanted” sound.

Technically, sound pressure level (SPL) is defined as:

$$\text{SPL} = 20 \log (P/P_{\text{ref}}) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and P_{ref} is the reference pressure, 20 μPa , which is approximately the lowest sound pressure that can be detected by the human ear.

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound sources, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined sound level of 53 dB, not 100 dB. Two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, background noise, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 6 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

Studies have shown conclusively that at equal sound pressure levels, people are generally more sensitive to certain higher frequency sounds (such as made by speech, horns, and whistles) than most lower frequency sounds (such as made by motors and engines) at the same level. To address this preferential response to frequency, the A-weighted scale was developed. The A-weighted scale adjusts the sound level in each frequency band in much the same manner that the human auditory system does. Thus the A-weighted sound level (read as "dBA") becomes a single number that defines the level of a sound and has some correlation with the sensitivity of the human ear to that sound. Different sounds with the same A-weighted sound level are perceived as being equally loud. The A-weighted noise level is commonly used today in environmental noise analysis and in noise regulations. Typical values of the A-weighted sound level of various noise sources are shown in Table 3.

Equivalent Sound Level

The Equivalent Sound Level (L_{eq}) is a type of average which represents the steady level that, integrated over a time period, would produce the same energy as the actual signal. The actual *instantaneous* noise levels typically fluctuate above and below the measured L_{eq} during the measurement period. The A-weighted L_{eq} is a common index for measuring environmental noise.

Table 3
Common Sound Levels in dBA

Common Outdoor Sounds	Sound Pressure Level (dBA)	Common Indoor Sounds	Subjective Evaluation
Auto horn at 10' Jackhammer at 50'	100	Newspaper press Textile mill	Deafening
Gas lawn mower at 4' Pneumatic drill at 50'	90	Auditorium during applause Food blender at 3'	Very Loud
Concrete mixer at 50' Jet flyover at 5000'	80	Telephone ringing at 8' Vacuum cleaner at 5'	
Large dog barking at 50' Large transformer at 50'	70	Electric shaver at 1' Clothes washer at 2'	Loud
Automobile at 55 mph at 150' Urban residential	60	Normal conversation at 3' Window air conditioning unit	
Birds at 25' Small town residence	50	Office noise Conference room background	Moderate
Wind in trees (5 mph) Farm valley	40	Soft stereo music in residence Library	
Rustling leaves	30	Average bedroom at night Soft whisper at 3'	Faint
Quiet rural nighttime	20	Broadcast and recording studio	
	10	Human breathing	Very Faint
	0	Threshold of hearing (audibility)	



NE Project: 14092

October 29, 2014

Beth Holliday

McDonald's at Alvernon Way & 22nd St
Tucson, Arizona

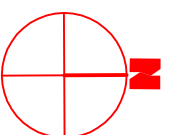
DESCRIPTION: Measurement Locations

SCALE: N/A

Figure No. 1



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October 29, 2014

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Figure No. 2



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McDonald's at Alvernon Way & 22nd St
 Tucson, Arizona

DESCRIPTION: Site Plan
 SCALE: N/A