DEPARTMENT OF PLANNING AND COMMUNITY DEVELOPMENT

1010 10th Street, Suite 3400, Modesto, CA 95354
Phone: 209.525.6330 Fax: 209.525.5911

Stanislaus County
Striving to be the Best

Date: May 7, 2015

TO: Stanislaus County Planning Commission

FROM: Department of Planning and Community Development

SUBJECT: USE PERMIT NO. 2002-21 – MAR, ADDAI CHURCH (LARSA EVENT CENTER)

DISCUSSION

Use Permit No. 2002-21 – Mar, Addai Church (Larsa Event Center) was originally scheduled for the April 16, 2015 Planning Commission meeting as an Other Matters item, to discuss the status of County efforts to address the project's compliance with Conditions of Approval and the Stanislaus County Noise Ordinance. Due to a lack of quorum, the April 16, 2015 meeting was canceled and all agenda items were rescheduled to be heard during the regularly scheduled May 7, 2015 Planning Commission meeting.

RECOMMENDATION

Based on the discussion in the April 16, 2015 Planning Commission Memo, staff is recommending the following options for Planning Commission consideration:

- Direct staff to schedule a public hearing to consider amending the Conditions of Approval as recommended by AEC in the Noise Study dated March 17, 2015, and as agreed to by Larsa; or
- Direct staff to take no further action based on sound levels under controlled conditions not being in violation of the County's Noise Ordinance.

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Attachments:

1 - UP 2002-21 – Mar, Addai Church (Larsa Event Center) April 16, 2015 Planning Commission Memo (with Attachments)

Stanislaus County
Striving to be the Best

DEPARTMENT OF PLANNING AND COMMUNITY DEVELOPMENT

1010 10th Street, Suite 3400, Modesto, CA 95354
Phone: 209.525.6330 Fax: 209.525.5911

April 16, 2015

MEMO TO: Stanislaus County Planning Commission

FROM: Department of Planning and Community Development

SUBJECT: USE PERMIT NO. 2002-21 – MAR, ADDAI CHURCH (LARSA EVENT CENTER)

BACKGROUND

The subject Use Permit was approved on January 16, 2003, allowing the construction of a church, multi-purpose building, and single-family dwelling on a 9.63 acre site in the A-2-10 (General Agriculture) zoning district. The site is located at 2107 E. Monte Vista Avenue, between Amethyst Way and N. Quincy Road, in the Turlock area. Since approval, the County has received multiple complaints from neighboring properties of Larsa's failure to comply with Conditions of Approval and the Stanislaus County Code Chapter 10.46 - Noise Control.

While Conditions of Approval for the church's Use Permit require compliance with certain decibel levels for noise, the County's Noise Control Ordinance, which supersedes the project's Conditions of Approval, requires that sound-amplifying equipment or live music not be audible to the human ear at a distance greater than 200 feet. The residences from which the complaints have been received are approximately 600 feet to the west from Larsa.

An item requesting consideration and direction of possible revocation of the subject Use Permit was originally presented to the Planning Commission on November 21, 2013. At that time, there were four potential violations of the Use Permit and County Code that were identified. The violations were: exceedance of operating hours; Noise Ordinance violations; non-permitted building improvements; and the placement of three non-permitted storage structures. After hearing from the neighbors affected by the noise and representatives of Larsa, the Planning Commission continued consideration of the matter to give the church six months to bring the project into compliance with the Conditions of Approval and to show a good faith effort towards resolving Larsa's impacts on the neighborhood.

Since November 21, 2013, the Use Permit has been returned to the Planning Commission on April 17, 2014, and October 16, 2014. Attachment A – *Memos to Planning Commission dated October 16, 2014, April 17, 2014, and November 21, 2013*, provides an overview of all the violations, concerns from the surrounding neighbors, and efforts taken by Larsa to address violations.

Efforts undertaken by Larsa include the installation of soundproofing and a new noise alert system which, at the time of the April 17, 2014, meeting, had not been tested as the alert system was not fully operational until April 2, 2014. Recognizing that winter and spring are slow seasons for Larsa, a request by a neighbor to allow for an additional six month trial period was supported by the Planning Commission, provided no more than four verified complaints were logged within the new six month review period. If four verified complaints were recorded in that

time period, then Planning staff was directed to bring the project back to the Planning Commission as soon as possible.

At the October 16, 2014, Planning Commission meeting, County Counsel indicated that the Stanislaus County Noise Ordinance was flawed and, as such, may need to be modified prior to rendering a decision on the subject project. Consequently, after the staff report and public comment period, the Planning Commission gave County staff six months to work through revisions to the Noise Ordinance, including the hiring of a noise consultant to conduct a noise study of the Larsa facility.

Since October 16, 2014, County staff has received a total of seven noise complaints, via email, on December 19, 2014, and January 24, February 14 and 28, and March 10, 28 and 29 of this year. Only three of the aforementioned noise complaints were filed directly with the Sheriff's Office. The deputy investigating the February 14 complaint indicated that the noise was not coming from Larsa; however, a source of the noise was not identified. On February 28, the investigating deputy stated that he could hear the noise once he was 100 yards from the Larsa building; however, he made no mention of hearing noise when he went to interview the complainant. The deputy investigating the March 28 complaint stated that he heard no music or yelling coming from Larsa; however, upon being dispatched three times that evening for noise complaints, the noise source was determined to be a residential party south of Larsa. The reporting parties were contacted by the deputy but were not willing to sign a complaint. As a result, there have been no verified complaints filed with the Sheriff's office since the October 16, 2014, hearing.

NOISE STUDY OVERVIEW

Following the October 16, 2014, Planning Commission meeting, the County hired a noise consultant who performed a mock-up sound test (noise study) of the Larsa facility on February 19, 2015. (See Attachment B – *Noise Study dated March 17, 2015.*) The purpose of the study was to identify appropriate interior sound levels and recommended interior noise control protocol for the Larsa facility to resolve the nuisance noise issue with the neighbors, while also providing a means of monitoring the interior noise levels going forward. The study also provides base line information that will help guide future revisions to the County's Noise Ordinance.

Local noise regulations typically rely on A-weighted sound level limits only, which are expressed as dB(A). A-weighting de-emphasizes low-frequency sound (bass), similar to the human ear, and approximates loudness and annoyance of noise. A-weighting is also useful for determining hearing damage caused by noise. The noise study incorporated C-weighting (or dB(C)) in addition to dB(A). C-weighting treats all frequencies of sound more equally, thus capturing the bass. The noise study further incorporated the use of octave or third-octave (1/3) frequency bands to judge the potential significance of the noise impact. The use of octave or third-octave allowed the sound engineer to obtain a detailed description of the frequency content of the noise. In the simplest terms, the use of dB(C) and 1/3 octave allowed the sound engineer to identify what sound frequencies are causing the problem and then to recommend appropriate solutions/mitigation to solve the problem.

The February 19, 2015, sound test included four test sites: west of Larsa at the nearest residential property line, the interior of the main event space at Larsa, near the Larsa property line directly west of the hall, and the master bedroom of one of the homes directly west of Larsa. The test was conducted from 8:25 p.m. to just after 11:25 p.m., with the music starting at 9:15 p.m. The test was essentially a mock event, where a DJ played music at typical worst-case

levels within the event facility to correlate interior source sound levels with those measured at the nearest residence. The noise study was a controlled condition and did not attempt to determine if there had been violations in the past. During the test, the interior noise level was measured at 100dB(A). (See Attachment B - *Noise Study dated March 17, 2015 - Figure 4.*) Under these conditions, the study found there was no violation of the County's noise ordinance, which does not have separate standards for bass frequencies, at Larsa's property line; however, when you look at the 50 Hz 1/3 octave, these bass frequencies are as much as 24 dB above the background noise levels and could be considered a "nuisance" by the surrounding neighbors.

While the noise study does identify recommended sound level limits proposed to reduce noise impacts to surrounding residents, the report concludes that:

> "*Implementing the proposed sound level limits will result in reduced noise impacts to surrounding residents. The proposed limits will not make event sound completely inaudible at the residential property line, but represents a compromise between the allowed use of the event facility and the protection of nearby residents."*

The following are the recommended sound level limits:

I. Larsa Interior Sound Level Limits

A. Between the daytime hours of 7 am to 10 pm, events at Larsa shall be limited to an L_{eq} of 102 dBC and a 1/3-octave band L_{eq} limit of 90 dB in each of the 50 Hz, 63 Hz, and 80 Hz third octave bands measured during any five minute period.

B. Between the nighttime hours of 10 pm to 7 am, events at Larsa shall be limited to an L_{eq} of 100 dBC and a 1/3-octave band L_{eq} limit of 85 dB in each of the 50 Hz, 63 Hz, and 80 Hz third octave bands measured during any five minute period.

C. Enforcement:

1. *Interior sound levels shall be continuously monitored for the duration of the event. Measurement microphone should be placed a minimum of 25 feet and not greater than 50 feet from the midpoint of the main speaker array.*
2. *A Type/Class 1 or 2 (per ANSI S1.43) measurement microphone system shall be used, calibrated prior to first use and at regular intervals. System shall be capable of measuring and logging Leq statistics over consecutive five minute intervals in both A and C weighted levels. System should also be capable of capturing and logging 1/3-octave band data.*
3. *For simplification and to minimize equipment costs, interior sound level limit triggers for both local monitoring and email notifications should be set to Leq, C-weighting. The DJ should locally check both C-weighted and 1/3-octave band results during sound check prior to an event to establish system gain limits and ensure compliance with the specified limits.*
4. *Monitoring equipment options:*

    a) *It appears that a viable iOS option is available in combination with an iPad/iPhone using microphone and acquisition hardware from AudioControl and software from Studio Six Digital. SSD software would include the AudioTools and several in-app purchases including SPL Graph and SPL Traffic Light.*
    b) *An alternative system proposed by Larsa's acoustical consultant.*
    c) *All proposed monitoring equipment shall be reviewed by AEC prior to first use.*

The results of the noise study and recommended sound level limits have been shared with Brett Dickerson, Counsel for Larsa, who has expressed, on behalf of his clients, the willingness to implement the recommendations as an amendment to the Use Permit's Conditions of Approval.

ISSUES AND PLANNING COMMISSION CONSIDERATION

When last presented to the Planning Commission, staff recommended that the Planning Commission direct staff to schedule a public hearing to consider revocation of the subject Use Permit based on verified noise complaints. Since that time, a flaw with the County's Noise Ordinance's subjective standard (sound-amplifying equipment or live music not being audible to the human ear at a distance greater than 200 feet) makes revocation on the grounds of a noise violation difficult.

Without applying the County's subjective noise standard, it is not clear if Larsa's events have been in compliance with the Use Permit Conditions of Approval and Noise Ordinance Standards; however, clearly the past operations of the Larsa facility have resulted in a nuisance to surrounding neighbors; therefore, to address the nuisance, it is necessary to focus on identifying sound level limits that work for the conditions of the Larsa facility and the neighboring properties. Amendments to the Noise Ordinance standards, while possible, will not control the interior noise levels at Larsa and without additional staffing, equipment, staff training/qualification, and a significant outlay of staff time to monitor the facility will not result in the ability to record the interior noise levels as recommended by the noise study.

With the information resulting from the February 19 sound test, staff is recommending the following options for Planning Commission consideration:

- Direct staff to schedule a public hearing to consider amending the Conditions of Approval as recommended by AEC in the Noise Study dated March 17, 2015, and as agreed to by Larsa; or
- Direct staff to take no further action based on sound levels under controlled conditions not being in violation of the County's Noise Ordinance.

Prepared by: Rachel Wyse, Associate Planner

Attachments:
A- Memos to Planning Commission dated October 16, 2014, April 17, 2014, and November 21, 2013. Attachments available online @: http://www.stancounty.com/planning/pl/agenda-min-2014.shtm
B - Noise Study dated March 17, 2015
C - Stanislaus County General Plan Definitions of Acoustical Terms

A complete copy of Use Permit No. 2002-21 – Mar, Addai Church Staff Report, and associated exhibits, is available at the County Planning Department.

DEPARTMENT OF PLANNING AND COMMUNITY DEVELOPMENT

1010 10th Street, Suite 3400, Modesto, CA 95354
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October 16, 2014

MEMO TO: Stanislaus County Planning Commission

FROM: Department of Planning and Community Development

SUBJECT: USE PERMIT NO. 2002-21 – MAR, ADDAI CHURCH (LARSA EVENT CENTER)

Staff requests the Planning Commission's direction regarding Use Permit No. 2002-21 – Mar, Addai Church (Larsa Event Center hereinafter referred to as "Larsa") due to multiple complaints from neighboring properties of the owner's failure to comply with Conditions of Approval and the Stanislaus County Code Chapter 10.46 - Noise Control.

BACKGROUND

This request was originally heard before the Planning Commission on November 21, 2013. At that time, there were four potential violations of the Use Permit and County Code that were presented to the Planning Commission. The violations were: exceedance of operating hours; Noise Ordinance violations; non-permitted building improvements; and the placement of three non-permitted storage structures. After hearing from the neighbors affected by the noise and representatives of Larsa, the Planning Commission continued the project to give the church six months to bring the project into compliance with the Conditions of Approval and to show a good faith effort towards resolving Larsa's impacts on the neighborhood.

This project was brought back to the Planning Commission on April 17, 2014, to consider compliance with Use Permit conditions. Three verified noise complaints had occurred since the November Planning Commission meeting; however, a neighbor had submitted a letter to the Planning Commission requesting an additional six month trial period as the winter/spring was a slow season for Larsa and the neighbor wanted the trial period extended through Larsa's busy season. Also, the church had installed soundproofing and a new noise alert system; however, the alert system was not fully operational until April 2, 2014, and had not been tested at an event. (See Attachment A - *Memo to Planning Commission dated April 17, 2014, with attachments*.) Consequently, the Planning Commission agreed to an additional six month review period, ending on September 30, 2014, provided no more than four verified complaints were logged within the new six month review period. If four verified complaints were recorded in that time period, then Planning staff was directed to bring the project back to the Planning Commission as soon as possible.

Since April 17, 2014, there have been multiple noise complaints received by the County from the neighborhood to the west regarding amplified music from the Larsa Event Center. (See Attachment B - *Stanislaus County Sheriff's Calls for Service Summary*.) Several complaints were deemed unverified because: 1) the deputy could not hear music/bass from the hall while at the complainants home; 2) the deputy identified the music/bass coming from another source; or 3) the event was over or shutting down when deputies arrived. Three complaints were verified by Stanislaus County deputies or the Sheriff on May 24, August 16, and September 6. (See Attachment C – *Verified Noise Complaints*.) The deputy who verified the May 24 complaint

indicated that, though the bass was audible within the complainant's home, it was not intolerable. The August 16 report indicates that the bass was faint, yet audible, from the backyards of the residences, and inaudible from within the residences except in one case where the window was cracked open in the master bedroom. The Sheriff's report for September 6 identifies a rhythmic bass sound, emanating from Larsa, as audible from Amethyst Avenue and the backyards of two residences.

While Conditions of Approval for the church's use permit required compliance with certain decibel levels for noise; the County's Noise Control Ordinance, which supersedes the project's Conditions of Approval, requires that sound-amplifying equipment or live music not be audible to the human ear at a distance greater than 200 feet. The residences from which the complaints were received are approximately 600 feet to the west from Larsa. While there were inadequate verified complaints to bring the project back before the six month review period; complaints continue to be received despite efforts undertaken by Larsa to reduce the noise impacts. Moreover, since the last Planning Commission meeting, staff has been notified by one of the complainants that they have been named in a lawsuit by Larsa.

ISSUES AND PLANNING COMMISSION CONSIDERATION

At this time, planning staff is seeking direction from the Planning Commission on how to proceed. If the Planning Commission believes any of the conditions or terms of the Larsa use permit may be in violation, it may direct staff to bring the item back to the Planning Commission for a full hearing to consider revocation of the Use Permit.

Prepared by: Rachel Wyse, Associate Planner

Attachments:
A - Memo to Planning Commission dated April 17, 2014, with attachments
B - Stanislaus County Sheriff's Calls for Service Summary
C - Verified Noise Complaints

A complete copy of Use Permit No. 2002-21 – Mar, Addai Church Staff Report, and associated exhibits, is available at the County Planning Department.

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April 17, 2014

MEMO TO: Stanislaus County Planning Commission

FROM: Department of Planning and Community Development

SUBJECT: USE PERMIT (UP) NO. 2002-21 – MAR, ADDAI CHURCH (LARSA EVENT CENTER)

Staff requests the Planning Commission's direction regarding Use Permit (UP) No. 2002-21 – Mar, Addai Church (Larsa Event Center) due to multiple complaints from neighboring properties of the owner's failure to comply with Conditions of Approval and the Stanislaus County Noise Ordinance.

BACKGROUND

This request was originally heard before the Planning Commission on November 21, 2013. After hearing from the neighbors affected by and representatives of the Mar, Addai Church (Larsa Event Center), the Planning Commission made the determination to give the church staff six (6) months to bring the project into compliance with the Conditions of Approval and to show a good faith effort towards resolving the church's impacts on the neighborhood. The November Planning Commission memo, in its entirety, is attached as Exhibit 3.

There were four violations of the Use Permit and County Code that were presented to the Planning Commission in November, 2013. They were:

- Operating hours have been exceeded;
- Excessive Noise Ordinance violations;
- Non-permitted building improvements; and
- Three (3) non-permitted storage structures.

There have been three verified complaints regarding excessive noise since the November 21, 2013, Planning Commission meeting. The first complaint occurred on November 23, 2013. The deputy noted that the bass noise coming from the hall was loud enough to be heard in the front yard of an Amethyst Way home over 200-feet away from the hall. The second complaint filed with the Sheriff's office occurred on January 26, 2014. According to the report, the complainant stated that the music ended at 10:00 p.m. and that no noise was present when the deputy arrived on location at 10:15 p.m. The third complaint occurred on February 8, 2014. The deputy stated that he could not hear the music or bass from within the residence and could, faintly, here the music from the backyard of the residence. The church, at the deputy's request, turned down the music.

The applicants applied for, were issued, and finaled Building Permit No. 2013-2354, legalizing the non-permitted building improvements that were made. The applicant filed Staff Approval Application No. PLN2014-0005 and building permits for the un-permitted storage structures. Staff is ready to approve and issue the Staff Approval Permit and sign-off on the building permits pending Planning Commission's decision on whether or not to begin revocation

proceedings. If the Planning Commission decides not to begin revocation proceedings, the aforementioned permits will be approved by staff.

Brett Dickerson, attorney for Larsa Event Center, provided a summary of steps taken to address noise emanating from the church site. According to Mr. Dickerson, noise is not the issue as evidenced by a noise assessment dated February 28, 2014. (See Exhibit 1 – *Letter dated March 31, 2014, from Brett Dickerson and attached noise study dated February 18, 2014*.) Noise and low frequency "beat" noises do not exceed the decibel levels recommended for the residential zone; however, as the bass or "beat" is impacting the neighbors, the church has opted to implement measures, as recommended by J.C. Brennan & Associates' noise assessment, to address the noise. To that end, insulation has been added to the stage and surrounding partition walls to mute noise. (See Exhibit 1 – *Letter dated March 31, 2014, from Brett Dickerson and attached noise study dated February 18, 2014*.) Mr. Dickerson's second letter stated that, as of March 28, the church has installed and tested an alert light which will indicate when the music becomes too loud. According to the field test, with the system working and the volume reduced there was, reportedly, no audible music beyond 200 feet. This alert system should allow the DJ to reduce the bass noise to within acceptable limits. Additional testing will be completed at the next scheduled event. (See Exhibit 2 – *Letter dated April 2, 2014, from Brett Dickerson.*)

During the drafting of this letter, staff received an email from an Amethyst Way neighbor concerned that the recent trial period occurred during the church's slow time and, as such, is not an accurate reflection of the number of events that occur on the church property during the summer months. The neighbors are receiving notice of the recent noise assessment, improvements to the church, and installation of insulation and noise detection system with the release of this memo.

ISSUES AND PLANNING COMMISSION CONSIDERATION

At this time, planning staff is seeking direction from the Planning Commission on how to proceed. If the Planning Commission believes any of the conditions or terms of the Mar, Addai Church use permit may be in violation, it may direct staff to bring the item back to the Commission for a full hearing to consider revocation of the use permit. If the Planning Commission believes that time is needed to determine if the new insulation and noise alert system is mitigating the noise, it may direct staff to bring the item back to the Planning Commission after a suitable trial period.

Prepared by: Rachel Wyse, Associate Planner

Attachments:
Exhibit 1 - Letter dated March 31, 2014, from Brett Dickerson and attached noise study dated February 18, 2014
Exhibit 2 - Letter dated April 2, 2014, from Brett Dickerson
Exhibit 3 - Memo to Planning Commission dated November 21, 2013, with attachments

A complete copy of UP 2002-21 – Mar, Addai Church Staff Report, and associated exhibits, is available at the County Planning Department.

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1010 10th Street, Suite 3400, Modesto, CA 95354
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November 21, 2013

MEMO TO: Stanislaus County Planning Commission

FROM: Department of Planning and Community Development

SUBJECT: USE PERMIT (UP) NO. 2002-21 – MAR, ADDAI CHURCH (LARSA EVENT CENTER)

Staff requests the Planning Commission's direction regarding Use Permit (UP) No. 2002-21 – Mar, Addai Church (Larsa Event Center) due to multiple complaints from neighboring properties of the owner's failure to comply with Conditions of Approval and the Stanislaus County Noise Ordinance.

BACKGROUND

UP 2002-21 was approved on January 16, 2003, allowing the construction of an 8,000 square foot church, a 30,000 square foot multipurpose building, and a single-family dwelling on a 9.63 acre site in the A-2-10 (General Agriculture) zoning district. The site is located at 2107 E. Monte Vista Avenue, between Amethyst Way and N. Quincy Road, in the City of Turlock's Sphere of Influence. (See *Attachment 2 – UP 2002-21 – Mar, Addai Church Staff Report.*)

The Use Permit allowed for construction of the multipurpose building and parking lot, in advance of the church building, to allow for services and church functions to occur while funding for construction of the church could be secured. The multipurpose building received an occupancy permit on April 1, 2009, and, soon thereafter, on June 16, 2009, the Department of Environmental Resources Code Enforcement Division (CE) began receiving complaints that the events at Larsa created excessive noise, traffic, light pollution, and operated beyond the approved hours of operation. Based on the complaints received, the following Conditions of Approval for this Use Permit are in violation: (*See Attachment 2 – UP 2002-21 – Mar, Addai Church Staff Report - Exhibit 1 - Conditions of Approval*)

2. The weekday hours of operation shall be 8:00 a.m. – 10:00 p.m. except Christmas, Easter, and New Years celebrations.

3. The Saturday hours of operations shall be 8:00 a.m. – 1: 00 a.m. except Christmas, Easter, and New Years celebrations. The Sunday hours of operation shall be 7:00 a.m. – 10:00 p.m. except Christmas, Easter, and New Years celebrations.

7. The off-site level of noise generated by the project shall not exceed a level of 60 Ldn measured in outdoor activity areas and/or 45 Ldn measured within interior living spaces. Costs associated with enforcement of this condition shall be the responsibility of the church.

10. All exterior lighting shall be designed (aimed down and towards the site) to provide adequate illumination without a glare effect.

In addition to the construction of the multipurpose building, three (3) storage structures have been placed on-site without land use authorization (they were not identified in the Use Permit) or building permits. (*See Attachment 6 – Notice to Builder.*)

In 2009, in response to the neighbor's complaints, the property owners/operators (Mar, Addai Church) were asked by the County to prepare a noise study and to shield the outdoor lights to prevent light glare. The Applicant adjusted the lighting and submitted the noise study on October 30, 2009. The noise study recommended several measures that would mitigate the noise generated by events at Larsa. While the noise study concluded that noise from the events was audible, at times, the measurements did not reflect a violation of the approved conditions.

Effective March 2, 2010, the County adopted a Noise Control Ordinance which established standards superseding use permit conditions of approval:

> "§10.46.060D. Sound-Amplifying Equipment and Live Music. No person shall install, use or operate sound amplifying equipment, or perform, or allow to be performed, live music unless the sound emanating from the sound amplifying equipment or live music shall not be audible to the human ear at a distance greater than 200 feet. **To the extent that these requirements conflict with any conditions of approval attached to an underlying land use permit, these requirements shall control."** (Emphasis added). (*See Attachment 4 – Stanislaus County Noise Control Ordinance.*)

Code Enforcement has received eight (8) complaints from July 16, 2009, until January 22, 2013. The Sheriff's Office has received 92 requests for service (complaints) from September 27, 2009, to May 18, 2013. The calls for service were as follows: noise disturbances (42), burglary/fire alarms (33), information (5), fights (4), emergency medical service (1), follow-up investigations (1), and other (7). The County Board of Supervisors, District Two, Supervisor Chiesa's Office, has received 19 complaints from March 18, 2012, to March 30, 2013, regarding noise. All of the complaints regarding noise and operating-hours violations came from the residential subdivision to the west and northwest of the Larsa property. There are anonymous callers; however, the three residents closest to the Larsa property have identified themselves.

After review of the complaints, staff believes the Mar Addai Church has violated the following Conditions of Approval:

- Exceeded Operating Hours: 4/25/10, 5/9/10, 6/6/10, 10/15/10, and 12/30/12
- Documented Noise Violations: 4/17/10, 4/25/10, 5/9/10, 5/15/10, 6/6/10, 10/15/10, 1/22/10, 3/28/11, 11/24/12, 3/31/13, 4/27/13, and 5/12/2013

Noise complaints received prior to the March 2, 2010, effective date of the County's Noise Control Ordinance were not included in the list of violations.

In a meeting on August 12, 2013, with County staff and representatives of the Mar Addai Church, Romina Kiryakous the events manager, and Kurk Royal, their contractor, stated that modifications consistent with the mitigation recommendations of the 2009 noise study had been completed in an effort to address the noise complaints. They indicated that modifications included additional weather stripping on doors, additional interior doors, and other like changes. During the meeting, Mrs. Kiryakous provided staff with two revised noise studies dated January

31, 2011, and February 3, 2011. (*See Attachment 3 – Noise Study and Addenda dated, October 30, 2009, January 31, 2011, and February 3, 2011, respectively*.) The noise study dated January 31, 2011, details work completed to the multipurpose building.

During the meeting, staff discussed the need to address the neighbor's continuing complaints regarding noise generated by the event center's activities and the hours of operation. Staff also noted the need for a building permit for the interior sound wall that had been installed and land use and building permits for the storage structures. The applicants agreed to obtain building permits within two (2) weeks of the August meeting. To date, an application for building permit for the interior improvements and storage structures has not been received.

ISSUES AND PLANNING COMMISSION CONSIDERATION

Currently there appear to be four violations of the Use Permit and County Code:

- Operating hours have been exceeded;
- Excessive Noise Ordinance Violations;
- Non-permitted building improvements; and
- Three (3) non-permitted storage structures.

At this time, planning staff is seeking direction from the Planning Commission on how to proceed. If the Planning Commission believes any of the conditions or terms of the Mar, Addai Church use permit may be in violation, it may direct staff to bring the item back to the Commission for a full hearing to consider revocation of the use permit.

Prepared by: Rachel Wyse, Associate Planner

Attachments:
1 – Maps
2 – UP 2002-21 – Mar, Addai Church Staff Report including the following:
Exhibit A – Applicant's Project Description; and
Exhibit G – Conditions of Approval
3 – Noise Study and Addenda dated, October 30, 2009, January 31, 2011, and February 3, 2011, respectively
4 – Stanislaus County Noise Control Ordinance
5 – Stanislaus County Sheriff's Calls for Service Summary
6 – Notice to Builder

A complete copy of UP 2002-21 – Mar, Addai Church Staff Report, and associated exhibits, is available at the County Planning Department.

AEC
ACOUSTICAL ENGINEERING CONSULTANTS
ACOUSTICS • NOISE & VIBRATION CONTROL • AUDIOVISUAL SYSTEM DESIGN

March 17, 2015

Thomas E. Boze
Deputy County Counsel
Stanislaus County Counsel
1010 Tenth Street, Suite 6400
Modesto, California 95354-0882

Subject: Results of Mock-up Sound Tests and Recommendations for Noise Control at Larsa Banquet Hall in Stanislaus County, California

Dear Mr. Boze:

Larsa Banquet Hall is an event facility located at 2107 East Monte Vista Avenue in Stanislaus County that opened in November of 2008. The 20,000 square foot plus banquet hall facility hosts a number of events from typical Sunday church services to weddings and business functions with an interior capacity for 1100 people. The facility is directly bordered by agricultural land that is undeveloped. The nearest residences are over 550 feet west and southeast of the center of the nearest building façade. The main noise concern for the facility is the use of rental sound systems and DJs for events where high sound levels are generated, typically weddings on a Friday or Saturday night, and the resulting impact on nearby residents. Specifically it is the low frequency or "bass" sounds that generate the most complaints among neighbors. Other events, such as business functions and normal church services, do not generate the level of overall sound or low frequency energy that triggers a negative response.

A noise impact study and follow-up letter reports have been provided by the Larsa acoustical consultant, J.C. Brennan & Associates. At the time of the initial studies the noise regulation within the Stanislaus County Code (Noise Ordinance) only contained a subjective nuisance section to address noise impacts, and the project was analyzed and compared with the objective criteria within the General Plan Noise Element addressing non-transportation noise sources. Since that time, Stanislaus County has implemented a new noise ordinance with both objective sound level limits and subjective assessment criteria. The vast majority of noise regulation objective limits, including those of Stanislaus County, are based on A-weighted sound level limits only and typically include a 5 dB penalty for music sources. A-weighting de-emphasizes low-frequency sound similar to average human hearing response and approximates loudness and annoyance of noise. Few regulations expand to include C-weighted limits (specifically for music sources). C-Weighting is a metric that is very close to a flat or un-weighted response that treats all frequencies of sound more equally. Even rarer is the inclusion of octave or third-octave frequency bands to judge the potential significance of impacts.

Mock-up sound tests were conducted on February 19, 2015 to provide additional assessment of the potential noise impacts and to try to develop reasonable limits for the project. Continuous sound level measurements were made at a point along the residential property line directly west of Larsa. Compared with Stanislaus County limits and by all traditional A-weighted and even C-weighted metrics the

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banquet hall meets the objective criteria without additional mitigation. However, the potential "nuisance" of the sound becomes clear when looking at specific 1/3-octave band frequencies compared with background levels. At one 1/3-octave frequency band in particular, 50 Hz, the full DJ sound system output including the use of subwoofers was as much as 24 dB above the background level using an L_{eq} measurement.

An assessment was also made of the acoustical quality of the Larsa building shell, in particular the roof/ceiling assembly. As expected, the lightweight roof/ceiling assembly was particularly deficient at 50 Hz, allowing sound in this frequency band to easily transmit through and radiate to the surrounding neighborhood. Larsa Banquet Hall meets all current objective noise level limits per Stanislaus County regulations. However, the facility currently does not meet subjective audibility noise standards related to sound amplifying equipment and may not meet previous subjective "nuisance" assessments depending on interpretation. AEC will be reviewing and providing recommendations for modifying the current Noise Ordinance for Stanislaus County to try to eliminate subjectivity. It is recommended that noise limits be placed on future events for Larsa Banquet Hall specifically addressing overall C-weighted sound levels with a specific limit for the 50 Hz and adjacent third-octave bands. The recommended daytime (7 am to 10 pm) limits are a five minute L_{eq} of 102 dBC and a 1/3-octave band L_{eq} limit of 90 dB in each of the 50 Hz, 63 Hz, and 80 Hz third octave bands. Nighttime limits should drop to a five minute L_{eq} of 100 dBC and a five minute 1/3-octave band L_{eq} limit of 85 dB in each of the 50 Hz, 63 Hz, and 80 Hz third octave bands. A noise monitoring system should be used that provides local warning to those operating the sound system within Larsa as well as provides email alerts to stakeholders when limits are exceeded. Long term it is recommended that if Larsa wants to remove imposed limits, significant improvement should be made to acoustical quality of the roof/ceiling assembly to limit the amount of low frequency sound that transmits to the exterior. This can be accomplished by reconstructing the roof by adding layer(s) of mass (e.g. GP DensDek), adding batt insulation directly on top of the ceiling tile to effectively improve the Ceiling Attenuation Class (CAC) rating, replacing the T-bar ceiling with a hard lid (and adding surface sound absorption back in), or some combination of these as needed.

Noise Regulations

Noise regulations for Stanislaus County are found in both the Chapter 4 Noise Element[1] of the Stanislaus County General Plan and the Noise Control section, Chapter 10.46, within the Stanislaus County Code[2]. The Noise Element is used to assess the potential for noise impacts associated with transportation and non-transportation sources prior to a project approval while the County Code (Noise Ordinance) addresses noise sources in use. Both noise regulations have varying standards depending on the time of day, duration of the noise source, and the presence of pure tones, speech, music or recurring impulse sounds. Stanislaus County Noise Element standards applicable to non-transportation sound sources are provided in Table 1 below:

TABLE 1. Maximum Allowable Noise Exposure Levels from Stationary Noise Sources (Table 4, 1994 Stanislaus County General Plan Noise Element)

Time Period	Exterior Hourly L_{eq}, dB(A)	Maximum Level, L_{MAX} dB(A)
Daytime 7 a.m. to 10 p.m.	55	75
Nighttime 10 p.m. to 7 a.m.	50	65

The limits of Table 1 apply at the property line of the noise sensitive receptor (i.e. residential property line). A 5 dB(A) penalty applies for pure tone noises, noise consisting primarily of speech or music, or for recurring impulsive noises.

Chapter 10.46 of the County of Stanislaus Code serves as the County's noise ordinance. It uses different statistical descriptors of sound than the Noise Element and more closely aligns with the State of California Model Community Noise Ordinance. It applies to non-transportation sound sources and sets limits based on the time of day, duration of the source, and the character of the sound. In addition to the L_{50} and L_{MAX} sound level descriptors, the noise ordinance incorporates the L_{25}, $L_{08.3}$, and $L_{01.7}$ statistics to encompass noise sources of varying durations within an hour. If existing background noise levels exceed those shown in Table 1, the allowable noise limit is increased to match the ambient levels. Similar to the noise element performance standards, a 5 dB(A) penalty applies to the noise level descriptors of Table 2 for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. Limits are almost identical to the State's Model Ordinance for rural suburban properties, except that the day/night limit differential is only 5 dB(A) instead of 10 dB(A) in the Model Ordinance.

TABLE 2. Exterior Sound Level Limits within Properties of Affected Noise Sensitive Receptors Due to Non-Transportation Noise Sources, from 10.46.050 of Stanislaus County Code

Property Type	Cumulative Duration of Intrusive Sound (Minutes Per Hour)	Sound Level Limits, dB(A)	
		Daytime (7 am to 10 pm)	Nighttime (10 pm to 7 am)
Residential	30 (L_{50})	50	45
	15 (L_{25})	55	50
	5 ($L_{08.3}$)	60	55
	1 ($L_{01.7}$)	65	60
	0 (L_{MAX})	70	65
	Music, impulse or tones penalty	-5	-5

Under 10.46.060 Stanislaus County Code has specific noise source standards that independently address sound-amplifying equipment and live music, technically applicable to Larsa events. It states:

> "D. Sound-Amplifying Equipment and Live Music. No person shall install, use or operate sound-amplifying equipment, or perform, or allowed to be performed, live music unless the sound emanating from the sound-amplifying equipment or live music shall not be audible to the human ear at a distance greater than two hundred feet. To the extent that these requirements conflict with any conditions of approval attached to an underlying land use permit, these requirements shall control."

Part C. under the same section could also apply, though it appears to be aimed at a homeowner or tenant impacting an adjacent neighbor or tenant:

> "C. Audio Equipment. No person shall operate any audio equipment, whether portable or not, between the hours of ten p.m. and seven a.m. such that it is audible to the human ear inside an inhabited dwelling other than a dwelling in which the equipment may be located. No person shall operate any audio equipment, whether portable or not, at any other time such that the equipment is audible to the human ear at a distance greater than fifty feet from the equipment."

City of Roseville Noise Ordinance & Other Regulations

Unlike most jurisdictions, the City of Roseville has adopted a Noise Ordinance that includes separate criteria aimed directly at amplified sound sources. Section 9.24.110 of the code uses A-weighted, C-weighted, and 1/3-octave band metrics in a one minute average, L_{eq} measurement to assess the potential for noise impacts from amplified sound. Table 3 below provides the amplified sound level limits per the City of Roseville Noise Ordinance applicable at the receiver property line:

TABLE 3. Sound Level Limits for Amplified Sound, per the City of Roseville Noise Ordinance 9.24.110

Sound Level Descriptor	Daytime (7 am to 10 pm)	Nighttime (10 pm to 7 am)
L_{eq}, A weighted (dBA)	50	45
L_{eq}, C weighted (dBC)	75	70
One-third octave band	10 dB increase in any one-third octave band	

The ordinance implies that the noise impact assessment for amplified sound is to start by first using the A-weighted metric to determine compliance. If the A-weighted sound cannot be effectively separated from the background then the C-weighted metric should be used. Lastly, if an accurate assessment cannot be made using A or C weighted levels, or if low frequency tones are still clearly audible to an acoustic expert, then the 1/3-octave band assessment shall be used. An increase of 10 dB or more in any one-third octave band (presumably over a properly established background spectrum) is considered a violation of the Noise Ordinance.

There is not much available from other U.S. city or county noise regulations directly addressing low frequency sound. One study was conducted in the UK[3] on low frequency sound from outdoor "pop" concerts. Although the study was not exactly precise, it concluded (based on surveys): "Sound levels (exterior at the residential property line) in excess of 80 dB in the 63 Hz or 125 Hz octave bands are likely to give rise to complaints of low frequency noise. Levels below 70 dB are likely to be acceptable." Translated to 1/3-octave bands these thresholds equate to 75 dB and 65 dB, respectively, in each of the third octave bands that make up the octave bands listed above. Various national criteria curves have been established for low frequency sound in European countries[4]. The reference curves list acceptable (residence interior) levels at 50 Hz between approximately 40 dB and 50 dB depending on the country, presence of pure tones, background sound, and other factors.

Field Sound Test Results

Mock-up sound tests were conducted on February 19, 2015 to provide additional assessment of the potential noise impacts and to try to develop reasonable limits for the project. A fixed measurement position was selected directly west of the Larsa building at the nearest residential property line designated Site #1. Continuous measurements were made in 5-minute intervals at this position using a Larson Davis 831 (s/n 2325) sound analyzer. A second fixed position was set for the interior of the main event space at Larsa approximately 40 feet from the speaker system designated Site #2. A CEL 593.C1L (s/n 016672) sound level analyzer was used for the interior test position. A third meter was used (CEL 633.C1 s/n 1111982) to take roaming spot measurements in 1/3-octave bands at various test positions. In addition to the first two sites, measurements were made at Site #3 near the Larsa property line west of the building and at Site #4 within the master bedroom of the home directly west of the Larsa building and Site #1. All three meters employ 1/2 inch random incidence condenser microphones. A Larson Davis CAL200 calibrator was used to calibrate these meters and the microphones to 114 dB at 1000 Hz before beginning measurements. The meters conform to the requirements of a Type I instrument per American National Standards Institute[5]. A windscreen covered each microphone during all sound measurements. Microphones were mounted on tripods approximately 5.5 feet above ground level. The first two meters

were set to measure statistical sound levels over consecutive 5-minute intervals to identify sources and variations in sound with time. Statistical sound level descriptors such as the L_{25}, L_{50} and L_{90} were used to quantify the duration of time a specific threshold was reached. These are, respectively, the sound levels exceeded 25 percent, 50 percent and 90 percent of the time. The sound level meters also capture the maximum sound level, L_{MAX} and the average sound level, L_{eq}. The Larson Davis meter was set to capture both A-weighted and C-weighted levels using slow and fast response time. Similar statistics were measured using the CEL 633 meter, though manually triggered intervals were set to one minute or five minutes using a fast response and data was collected in 1/3-octave band frequencies as well.

Acoustical testing was conducted on a Thursday evening/night to minimize background levels and compare with typical event times. Measurements began at 8:25 pm at the residential property line starting with the capture of background levels. The mock-up event began at approximately 9:15 pm with the DJ playing music representing "worst case" event sound levels both in terms of A-weighted levels and bass levels. The DJ system consisted of numerous powered full range loudspeakers and subwoofers fed by a mixing board and laptop source. Music continued at full range levels until about 10:55 pm when bass (below 250 Hz) levels were equalized down. Subwoofer speakers were completely turned off at 11:15 pm and the music stopped 10 minutes later. Background levels were captured again after 11:25 pm. The final test for the night was to measure the Transmission Loss (TL) of the roof/ceiling assembly, suspected to be the weakest path for sound transmission from the interior to the exterior. Starting around midnight pink noise was played through the DJ speaker system at a high reference level. Measurements were made both on the source side on the interior and the receive side on the roof directly above. The difference between source and receiver levels was calculated to review the effectiveness of the roof/ceiling assembly as an acoustical barrier.

Displayed in Figure 1 are the results of continuous measurements made at Site #1 at the residential property line. L_{eq} and L_{MAX} statistical data are presented using both A and C weightings (fast response) in addition to L50 and L90 statistics. As shown in the Figure, there was only a minor increase in A-weighted L_{eq} sound levels of up to 4 dBA (negligible change at the start of testing due to higher background levels, dropping from about 36 to 32 dBA at the end of testing) between the steady-state background and full range music levels. Also, the A-weighted L_{eq} statistic was influenced heavily by trains passing nearby and other local events. A-weighted levels were below Stanislaus County Noise Element (L_{eq} of 45 dBA) and Noise Ordinance (L_{50} of 40 dBA) nighttime limits including the penalty for a source that is primarily music. The change was much more noticeable when looking at C-weighted L_{eq} levels, as expected given the concentration of low frequency energy. Still, C-weighted levels would meet the City of Roseville 70 dBC nighttime limit specifically set for amplified sound.

The difference between background and event levels is clearer when presented with the 1/3-octave band frequency data as shown in Figure 2. Background levels dropped between the beginning and end of the test period as sources such as nearby road traffic diminished. The dominance of the 50 Hz tone is clearly evident in Figure 2. The difference between the music with low frequency content equalized down and the early background measurement (8:45 pm) at 50 Hz is approximately 10 dB, right at the threshold used to judge significance per the City of Roseville standards. Up to a 24 dB increase at 50 Hz over the background levels at the end of testing (measured around 11:30 pm) occurred with the music at "full" output. Note that the level at 50 Hz was approximately 61 dB at full music output, lower than the 65 dB threshold that the UK pop concert study concluded that levels are likely to be acceptable. Similar results can be found in Figure 3, where sample measurements were taken inside the nearest home directly west of Larsa. The 50 Hz tone was actually higher inside the master bedroom with the sliding door open than it was at the property line, likely due to a combination of a particular song with greater bass content and possible room gain (acoustical amplification due to room geometry including reflections off of wall and ceiling surfaces). While the 50 Hz tone was significantly reduced with the door closed, the tone is still clearly evident. Subjectively the measurements match what was observed. Even with the door and windows closed the repetitive bass "beat" was audible over the background. 47 dB at 50 Hz matches the

upper mid-range limits of various national criteria from European countries. No measurements were made inside the home with the low frequency content equalized down; however, based on property line measurements approximately 8 dB reduction would be expected at 50 Hz. Depending on background levels within the bedroom, dropping 8 dB at 50 Hz and keeping the windows and doors closed could result in the music becoming inaudible or not discernable over background sources with a drop below 40 dB at 50 Hz. Figure 4 shows a comparison between the frequency content of sound measured inside Larsa with measurements made at the residential property line. Equalizing the low frequency down in the mock-up test resulted in a fairly flat frequency response that should also be reasonable for maintaining the guest experience at a Larsa event. The Larsa interior difference at 50 Hz was also 8 dB between the full and equalized music output, a one for one correlation between interior source levels and those measured at the property line.

Transmission loss of the roof/ceiling assembly was evaluated with results shown in Figure 5. The assembly was particularly deficient at 50 Hz with a TL of only 11 dB at this frequency band, contributing to the problem of elevated 50 Hz levels measured at the residential property line. Similar to ASTM E966, Outdoor-Indoor Level Reduction (OILR) data was compared with standard Sound Transmission Class (STC) curves resulting in a Field STC rating of 42. Although an FSTC rating of 42 is not particularly weak, STC (similar to A-weighting) tends to de-emphasize low frequencies. The deficiency at 50 Hz and nearby frequencies is due primarily to a lack of mass in the existing roof/ceiling assembly. Transmission through the roof as the primary weak path for sound exiting the Larsa building places the sound "source" at the top of the building and elevated above the influence of any property line sound walls. The omnidirectional radiation pattern of low frequencies also minimizes the effect that taller parapet walls would have on reducing sound levels. Reduction must come from controlling interior source sound levels and/or improving the low frequency isolation qualities of the roof/ceiling assembly.

Recommendations

Noise control for an indoor/outdoor sound source can be separated into three areas:

1) Control at the source – reducing the sound power output of the equipment or process by design or retrofit.
2) Path noise control or direct field control – isolate noise sensitive receivers by increasing distance from the noise source or providing acoustical barriers between the noise source and receiver.
3) Control at the receiver – improving the sound isolating qualities of the structure surrounding the noise sensitive receiver.

Control of noise primarily at the source is typically the best and most cost effective method as is the case for Larsa. The only cost for placing limits on interior sound levels, particularly at low frequencies, is for the monitoring and warning equipment and setup. However, care must be taken not to significantly alter the experience of guests using the Larsa Banquet Hall for events. Path noise control would require the modification of the roof/ceiling assembly to limit the amount of low frequency sound that transmits to the exterior. This can be accomplished by reconstructing the roof by adding layer(s) of mass (e.g. GP DensDek), adding batt insulation directly on top of the ceiling tile to effectively improve the Ceiling Attenuation Class (CAC) rating, replacing the T-bar ceiling with a hard lid (and adding surface sound absorption back in to compensate for the loss of absorption by the ceiling tile removal), or some combination of these as needed. Interior noise limits can be revisited after the roof/ceiling assembly has been modified if Larsa decides to pursue this approach. Control of noise at the receiver is probably the least feasible or cost effective, as it would require the addition of secondary sound control windows and doors to improve the sound isolation qualities of the building façade for each of the impacted homes. Recommendations for interior sound level limits are outlined below:

I. Larsa Interior Sound Level Limits

A. Between the daytime hours of 7 am to 10 pm, events at Larsa shall be limited to an L_{eq} of 102 dBC and a 1/3-octave band L_{eq} limit of 90 dB in each of the 50 Hz, 63 Hz, and 80 Hz third octave bands measured during any five minute period.
B. Between the nighttime hours of 10 pm to 7 am, events at Larsa shall be limited to an L_{eq} of 100 dBC and a 1/3-octave band L_{eq} limit of 85 dB in each of the 50 Hz, 63 Hz, and 80 Hz third octave bands measured during any five minute period.
C. Enforcement:

1. Interior sound levels shall be continuously monitored for the duration of the event. Measurement microphone should be placed a minimum of 25 feet and not greater than 50 feet from the midpoint of the main speaker array.
2. A Type/Class 1 or 2 (per ANSI S1.43) measurement microphone system shall be used, calibrated prior to first use and at regular intervals. System shall be capable of measuring and logging Leq statistics over consecutive five minute intervals in both A and C weighted levels. System should also be capable of capturing and logging 1/3-octave band data.
3. For simplification and to minimize equipment costs, interior sound level limit triggers for both local monitoring and email notifications should be set to Leq, C-weighting. The DJ should locally check both C-weighted and 1/3-octave band results during sound check prior to an event to establish system gain limits and ensure compliance with the specified limits.
4. Monitoring equipment options:

a) It appears that a viable iOS option is available in combination with an iPad/iPhone using microphone and acquisition hardware from AudioControl and software from Studio Six Digital. SSD software would include the AudioTools and several in-app purchases including SPL Graph and SPL Traffic Light.
b) An alternative system proposed by Larsa's acoustical consultant.
c) All proposed monitoring equipment shall be reviewed by AEC prior to first use.

Implementing the proposed sound level limits will result in reduced noise impacts to surrounding residents. The proposed limits will not make event sound completely inaudible at the residential property line, but represents a compromise between the allowed use of the event facility and the protection of nearby residents. Please contact me with any questions or comments regarding the results and recommendations presented in this report.

Sincerely,

Brian R. Smith

Brian R. Smith, INCE Board Certified
Principal

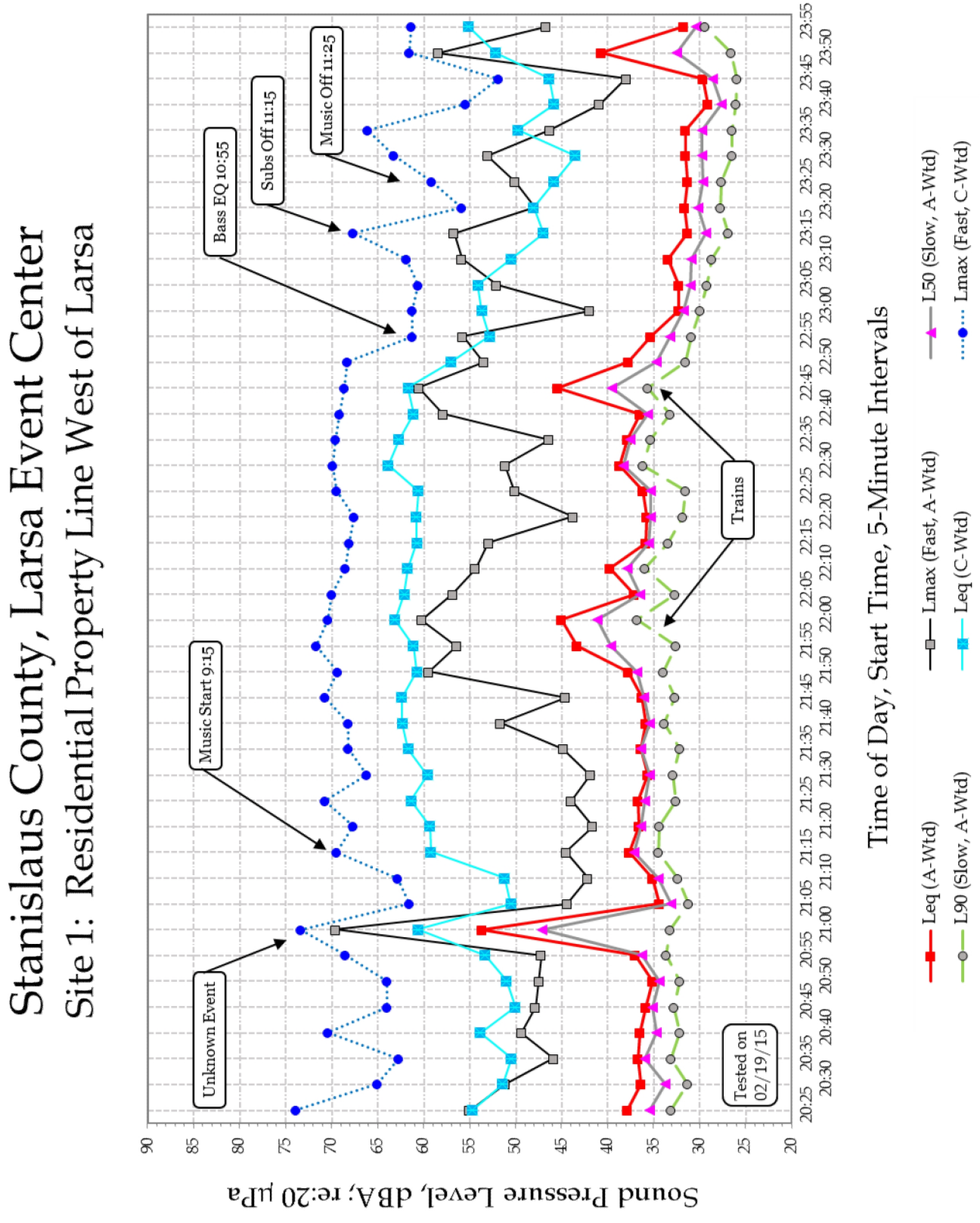

Figure 1. Results of Continuous Sound Level Measurements Made at Residential Property Line West of Larsa.

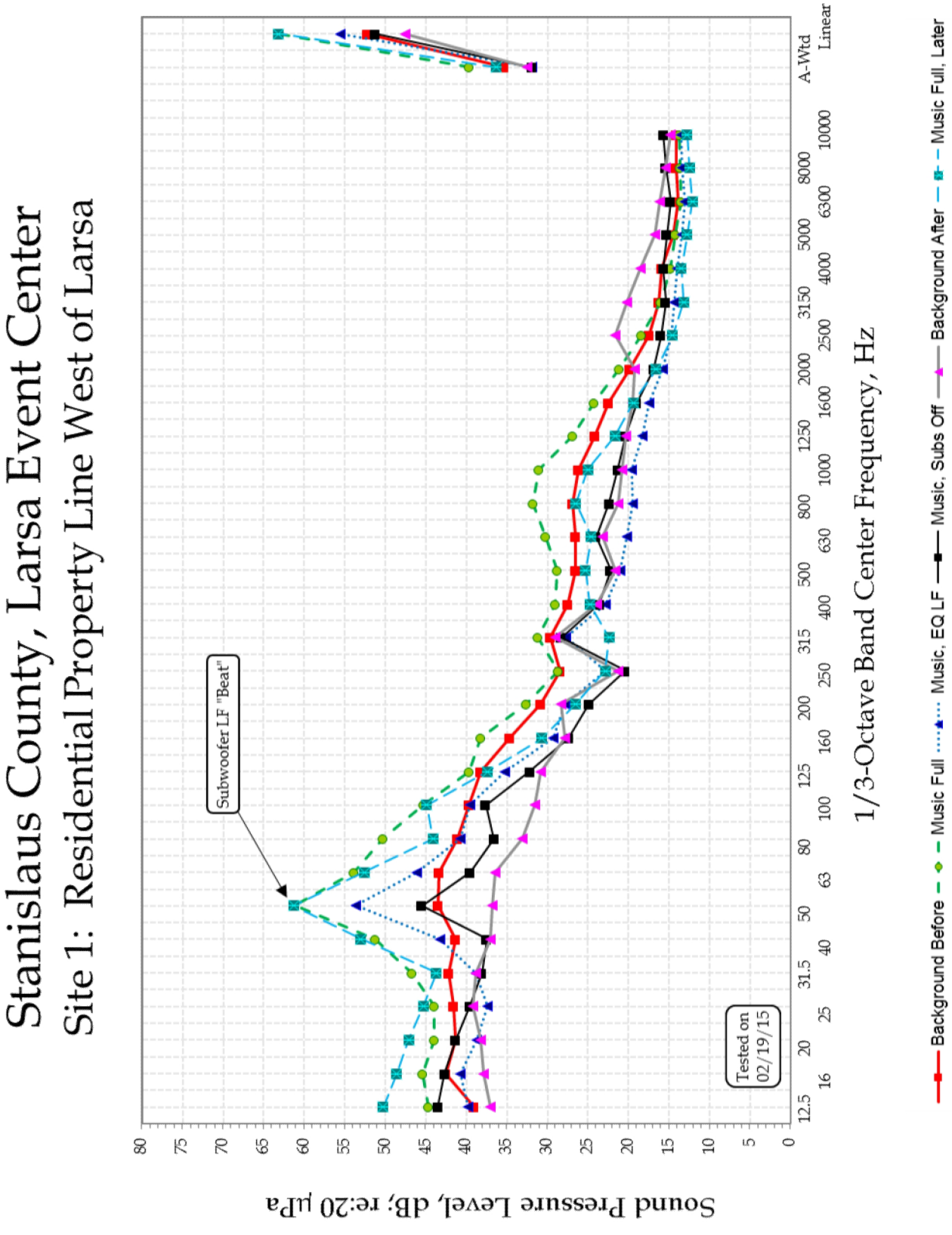

Figure 2. Comparison of 1/3-Octave Band Measurements of Various Music Levels Measured at Site #1.

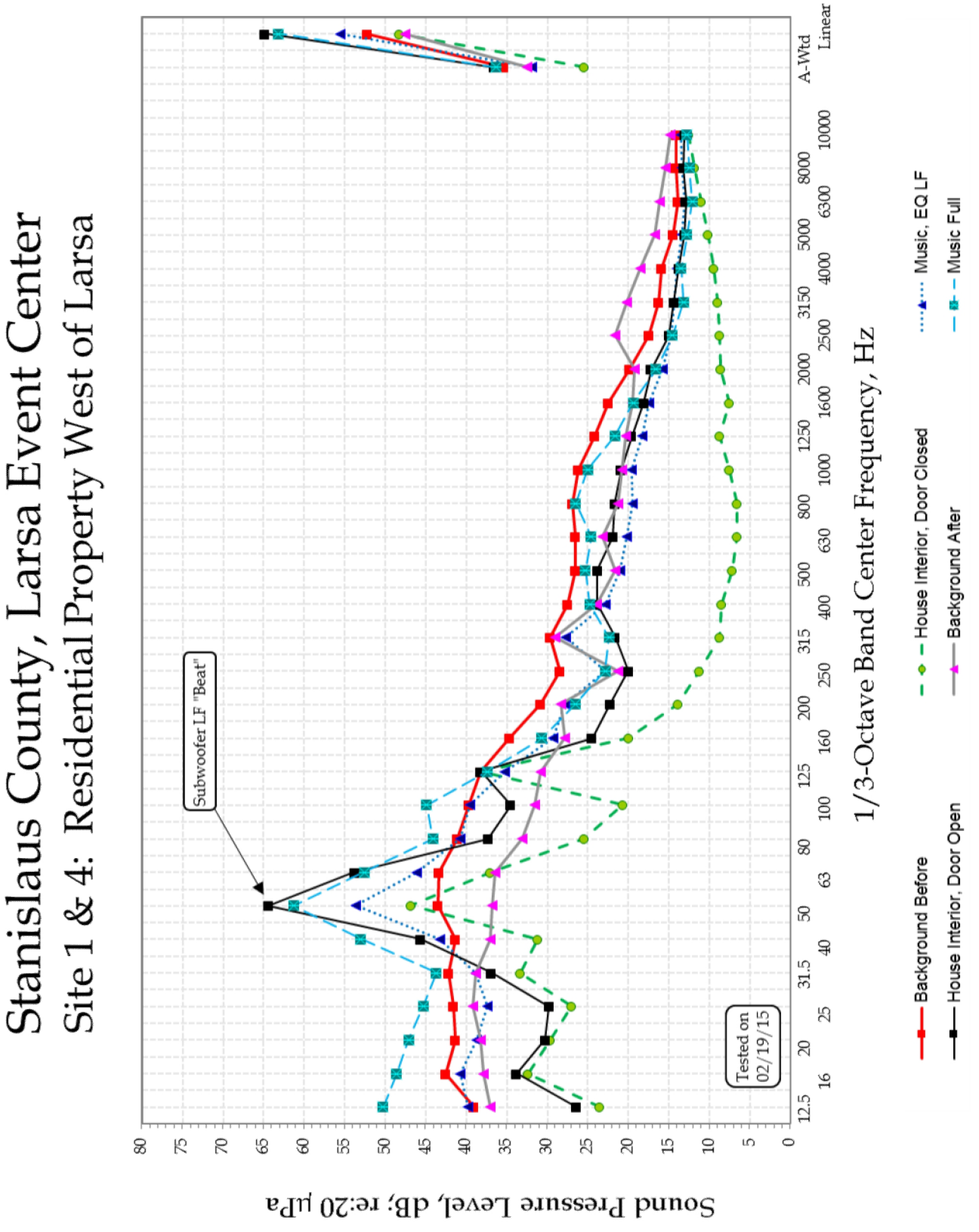

Figure 3. Residential Property Line and Home Interior 1/3-Octave Band Measurement Results.

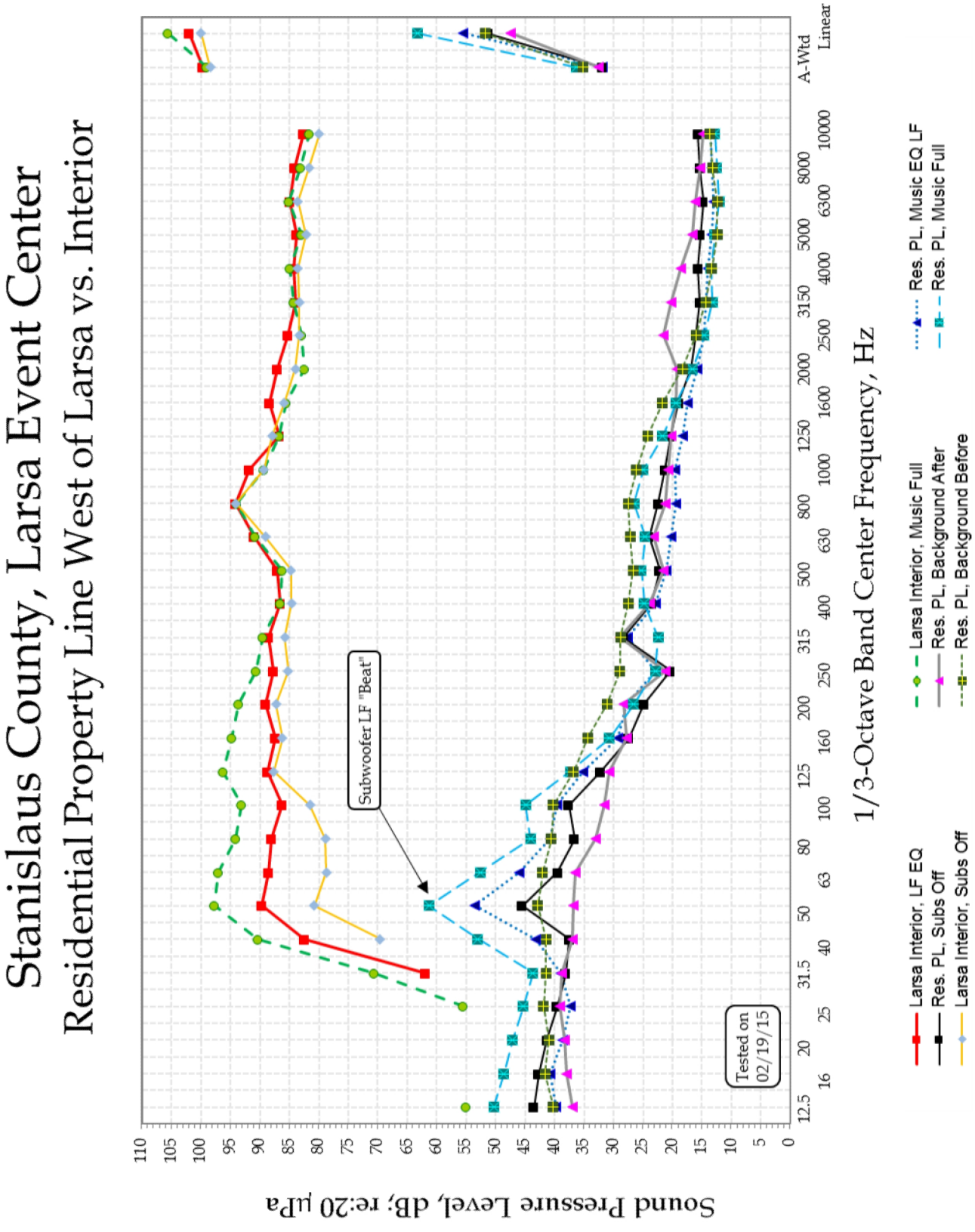

Figure 4. Comparison of Larsa Interior and Residential Property Line 1/3-Octave Band Sound Level Results.

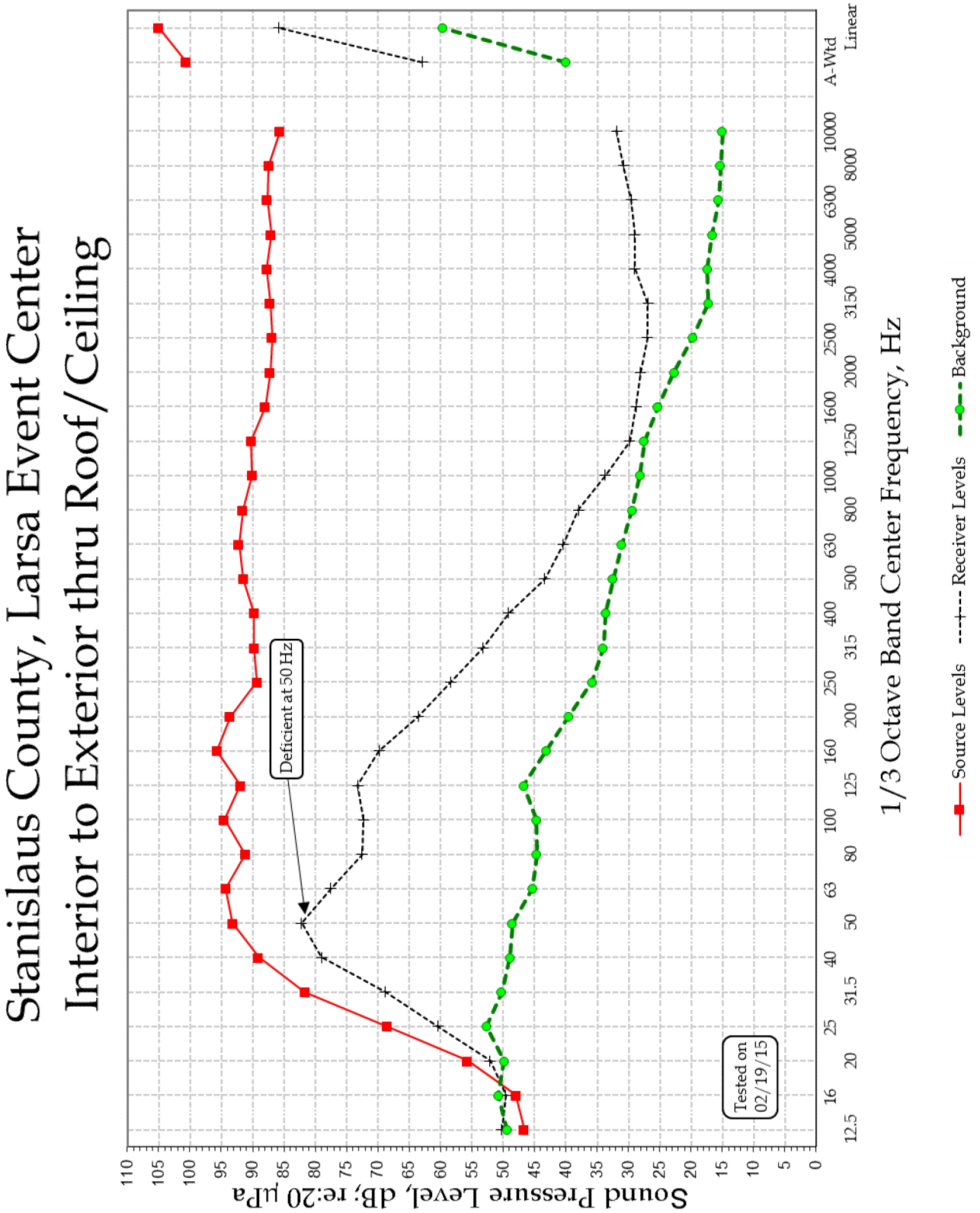

Figure 5. Source, Receiver, and Background Levels of the Roof/Ceiling Assembly Transmission Loss Test.

[1] *1994 Stanislaus County General Plan, Chapter 4 Noise Element,* Stanislaus County, Updated Noise Element Adopted April 18, 2006 http://www.stancounty.com/planning/pl/general-plan.shtm

[2] *Stanislaus County Code,* Stanislaus County, California; Chapter 10.46 Noise Control, Current through January 2014 Code Supplement, Published by Quality Code Publishing, Seattle, WA. Web. http://qcode.us/codes/stanislauscounty/

[3] Griffiths, J. E. T., J. Staunton and S. Kamath (1993). "A study of low frequency sound from pop concerts," Proc. Inst. of Acoustics Vol. 15 Part 7

[4] Moorhouse, Dr. Andy, Dr. David Waddington, and Dr. Mags Adams. "Proposed Criteria for the Assessment of Low Frequency Noise Disturbance." (2005): Page 12 of 113. Acoustics Research Centre, Salford University. Web.http://archive.defra.gov.uk/environment/quality/noise/research/lowfrequency/documents/nanr45-criteria.pdf

[5] American National Standards Institute, ANSI, Standard Specification for Sound Level Meters, S1.4-1983 (Precision)

A. Introduction

This Technical Reference Document is a supplement to the Noise Element of the General Plan, which provides background information concerning the methods and data used in preparation of the Noise Element. It is intended that this document be used by Stanislaus County as a resource when evaluating noise related implications of specific development proposals or long-range planning efforts. A brief discussion of acoustical fundamentals is presented to assist the reader in understanding the subsequent discussion. The discussion of the existing noise environment is based upon the results of a noise monitoring survey conducted in July and August 2004 and supplemented by the noise study report prepared by Illingworth & Rodkin, Inc. for the Ceres Southern Gateway Study. This study focuses on transportation noise sources such as vehicular traffic, railroad noise, and aircraft activities. Major industrial facilities in the County are also discussed.

B. Fundamentals of Acoustics

1. Measuring Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its pitch or its loudness. Pitch is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. Loudness is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A decibel (dB) is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the A-weighted sound level or dBA. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called Leq. The most common averaging period is hourly, but Leq can describe any series of noise events of arbitrary duration.

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The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

TABLE 1: DEFINITIONS OF ACOUSTICAL TERMS

Term	Definitions
Decibel, dB	A unit 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).
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level, dBA	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 frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless reported otherwise.
L01, L10, L50, L90	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Equivalent Noise Level, Leq	The average A-weighted noise level during the measurement period.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Day/Night Noise Level, Ldn	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Lmax, Lmin	The maximum and minimum A-weighted noise level during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

TABLE 2 TYPICAL SOUND LEVELS

Noise Generators (At a Given Distance from Noise Source)	A-Weighted Sound Level in Decibel	Noise Environments	Subjective Impression
	140		
Civil defense siren (100 feet)	130		
Jet take-off (200 feet)	120		Pain threshold
	110	Rock music concert	
Diesel pile drive (100 feet)	100		Very loud
Freight cars (50 feet)	90	Boiler room Printing press plant	
Pneumatic drill (50 feet)	80	In kitchen with garbage disposal running	Moderately loud
Freeway (100 feet) Vacuum cleaner (10 feet)	70		
	60	Data processing center	
Light traffic (100 feet) Large transformer (200 feet)	50	Department store	
	40	Private business office	Quiet
Soft whisper (5 feet)	30	Quiet bedroom	
	20	Recording studio	
	10		Threshold of hearing
	0		

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The Community Noise Equivalent Level, CNEL, is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 p.m. - 10:00 p.m.) and a 10 dB addition to nocturnal (10:00 p.m. - 7:00 a.m.) noise levels. The Day/Night Average Sound Level, Ldn, is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.