City of Santa Clara

City Council Meeting – December 19, 2017

Study Session: Noise Monitoring

Item 6.A

City of Santa Clara
The Center of What's Possible

Noise Monitoring Study Session

Objectives

1. Provide an Overview of Noise Monitoring
2. Review Specific Results of Noise Monitoring for the Stadium
3. Receive City Council Input for Next Steps for the Noise Monitoring Program

Noise Monitoring Program

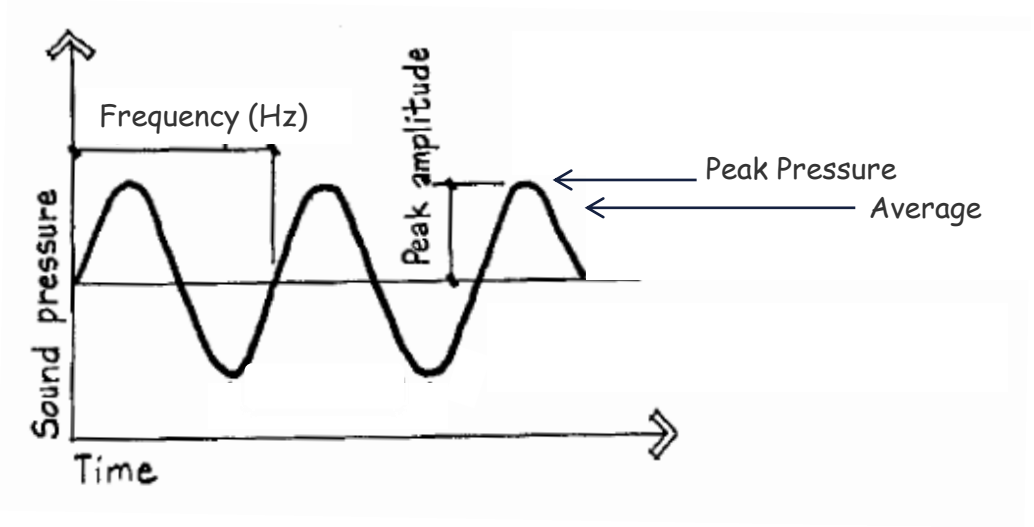
Study Session Topics

1. Noise Fundamentals
2. City Noise Regulations
3. Environmental Noise Analysis
4. Levi's Stadium Permit
5. Levi's Stadium Noise Monitoring Data
6. Next Steps

Noise Fundamentals

- Sound: mechanical waves that propagate through the air

dB



- Noise is usually defined as unwanted sound

Noise Fundamentals

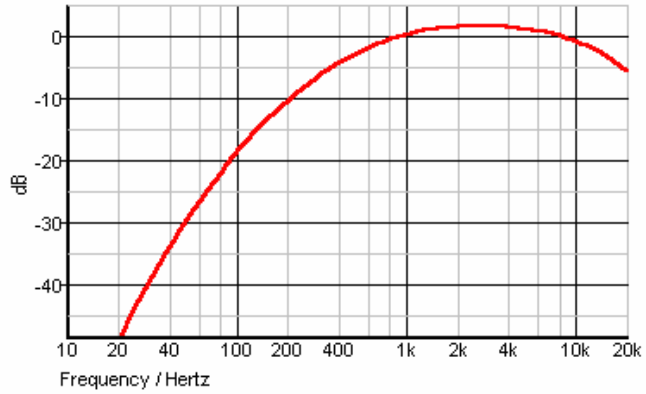
Characterizing Sound: Amplitude – decibels (dB)

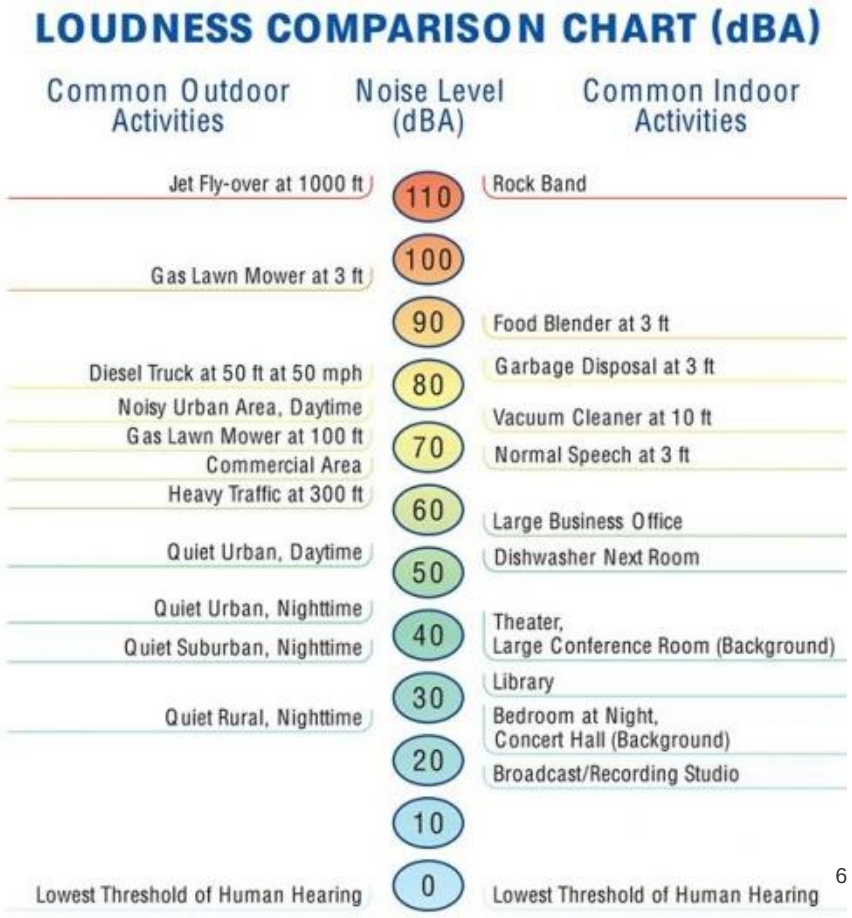
- Correlates with "loudness"
- Rules of thumb:
  - 1 dB change Not perceptible
  - 3 dB change Barely noticeable
  - 5 dB change Noticeable
  - 10 dB change Very noticeable
- Logarithmic scale: 60 dB + 60 dB = 63 dB

Noise Fundamentals

Characterizing Sound: Frequency – Hertz (Hz)

- 20 to 20,000 Hz
- A-weighting curve - dBA





Noise Fundamentals

Noise Metrics

- Maximum
  - typically every 1 second
- Average
  - typically over 1 hour
  - aka, "equivalent level", Leq
- CNEL and Ldn
  - 24-hour weighted averages

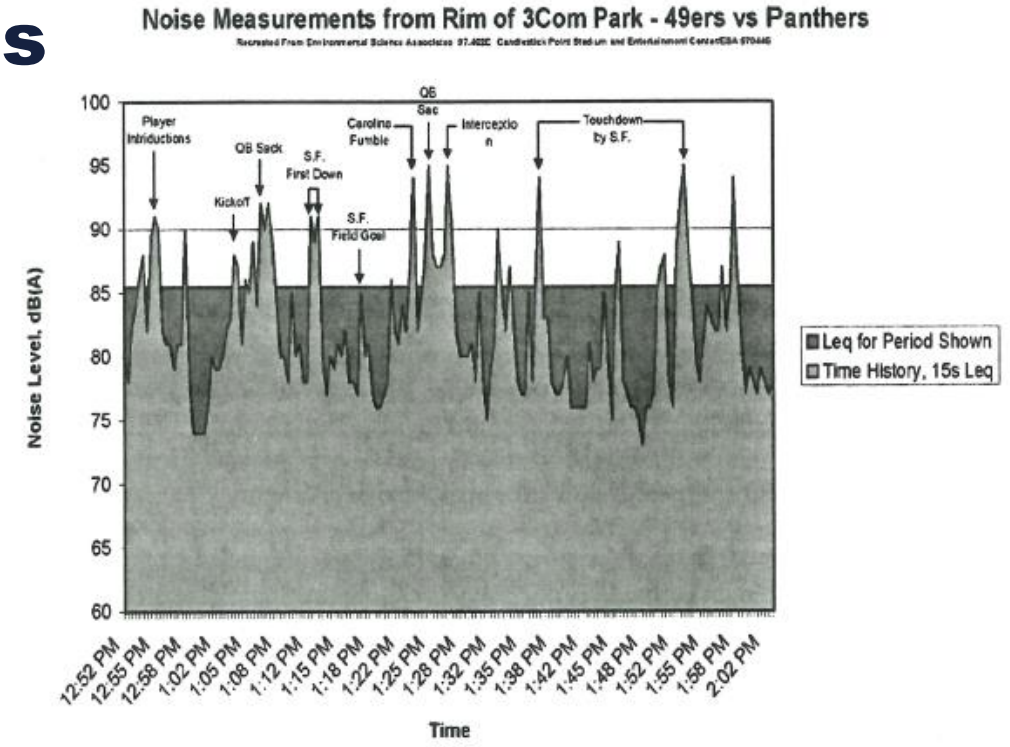


Figure 1 – Distribution of sound levels during an NFL football game

Noise Regulation -- Citywide

City of Santa Clara Noise Ordinance

- Limits noise from "fixed sources"

Time Period	Basic Limit	Music/Speech Limit
7 AM – 10 PM	55 dBA	50 dBA
10 PM – 7 AM	50 dBA	45 dBA

- Does not limit noises from mobile sources, including "portable music amplifiers"

Noise Regulation -- Citywide

City of Santa Clara Noise Ordinance – Exceptions (9.10.070)

- (c) Outdoor events which are conducted pursuant to a valid permit or license issued by the City relative to the staging of said events
- (f) Firework displays authorized by permit from the City of Santa Clara Fire Department

Levi's© Stadium activities are regulated through Stadium Zoning

CEQA Analysis

Prior to City Council approval of the Stadium Zoning, the City prepared an Environmental Impact Report (EIR) to fulfill the requirements of the California Environmental Quality Act (CEQA)

Purpose of the EIR

- Provides information to decision makers
- Discloses potentially significant environmental impacts
- Identifies mitigation measures to reduce environmental impacts
- Does not establish policy

Levi's© Stadium Environmental Study

Draft Environmental Impact Report (DEIR) – July 2009

- Described high existing (background) ambient noise levels
- Identified significant noise impact for the stadium operations
- City Council adopted a Statement of Over-riding Considerations for significant environmental impacts identified in the EIR including:

1. Impact NOI-5: NFL Games – Significant Unavoidable Impact
2. Impact NOI-6: Non-NFL Sports – Significant Unavoidable Impact
3. Impact NOI-7: Concerts – Significant Unavoidable Impact

Levi's© Stadium Design Study

Additional Noise Study – WJHW, May 2010

- Prepared to further address noise impacts identified in the EIR.
- Provided guidance to optimize the stadium PA and other sound systems
- Noted that CNEL not appropriate
- Recommend **60 dBA, $L_{eq,1hr}$** as the design criteria
- Used as basis for Zoning (Permit) Standard

Levi's© Stadium Zoning

Development Permit Condition P23

"In order to control noise, the stadium loudspeaker system (permanent and temporary) shall be oriented in a manner consistent with Community Noise Analysis prepared by WJHW, dated May 27, 2010 for the proposed 49ers Stadium, in order to control noise impacts to adjacent neighborhoods. In accordance with Section 9.10.070(c) of the Santa Clara City Code, and the recommendations of this noise analysis, sound system levels shall be limited to 100 dBA for NFL games and other uses of the permanent speaker system, and not more than 105 dBA for temporary concert speaker systems as presented in the analysis. For sound system installations and modifications within the stadium site, the target for maximum sound level exposure in residential areas to the east and south shall be 60 dBA"

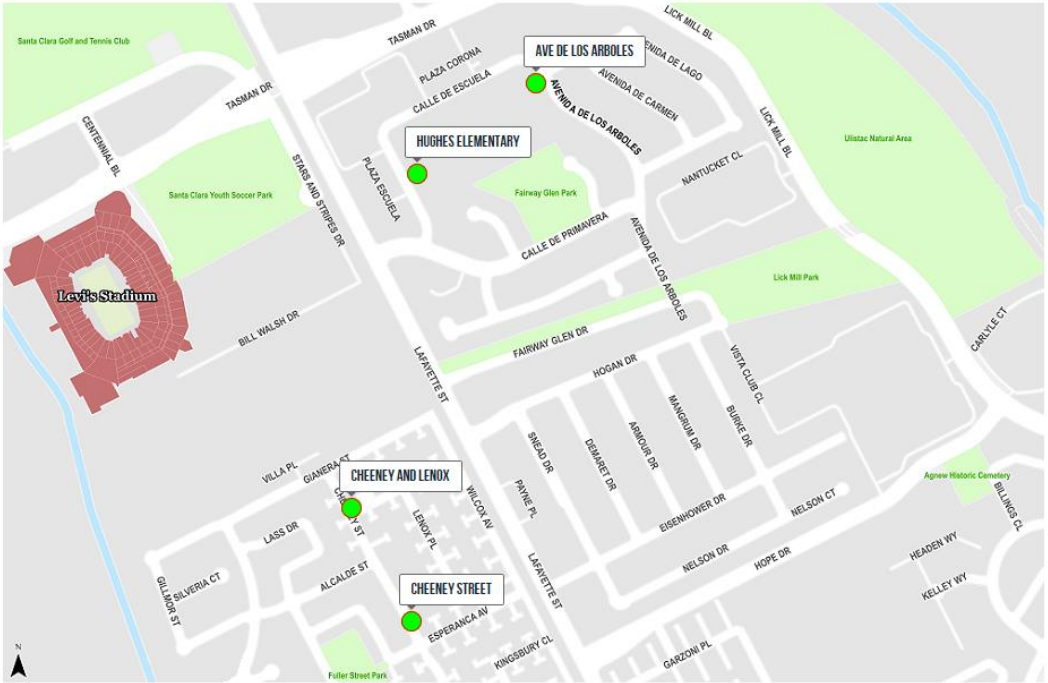
Levi's© Stadium Noise Monitoring

- Manually monitored U2 Concert (May)
  - Data & Observations
  - Everything recorded – highest quality data
  - Labor intensive to collect – expensive
  - Post-processing can be expensive

- Noise Monitors Installed (July - Present)
  - Automated – cheap to collect lots of data
  - Automated – can post data on City website
  - Only limited recordings – can be hard to figure out
  - If a lot of post-processing is desired, expensive

Levi's© Stadium Noise Monitoring

Monitor Locations



Levi's© Stadium Noise Monitoring

TABLE : SUMMARY OF MEASURED NOISE LEVELS – ATTENDED U2 CONCERT

Location	Source	Fluctuating Noise Levels (dBA)			Average (dBA)**	Observations
		Min	Core Range*	Max		
Cheeney & Lenox	Background	48	48 – 52	52		
	Jet Aircraft	73	73 – 77	77		
	Cars	63	63 – 64	64		
	Concert	50	56 – 64	70	**61**	Lyrics plainly audible
4624 Cheeney	**Concert**	47	54 – 60	66	**58**	Lyrics plainly audible
Hughes Elementary	**Concert**	49	52 – 58	64	**56**	Lyrics audible. Includes some helicopter noise.
Arboles & Lago	**Concert**	43	46 – 52	57	**50**	Lyrics not audible

***Core Range = L_{90} to L_{10}**

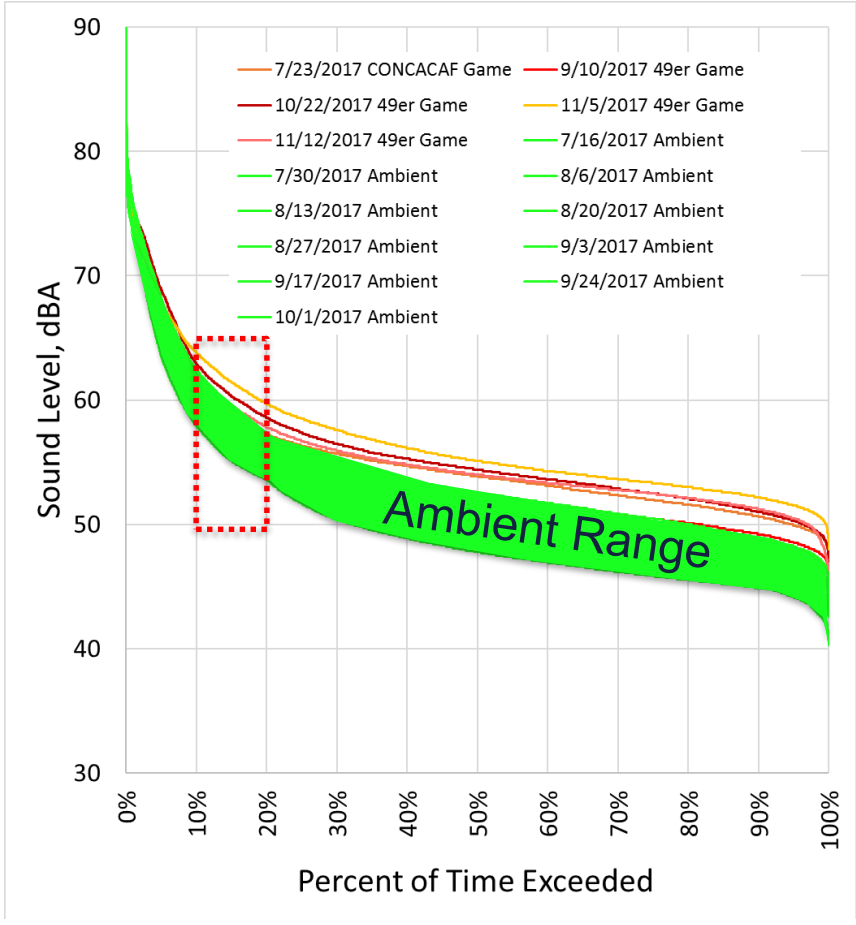
****Compliance = 60 dBA**

Levi's© Stadium Noise Monitoring

TABLE : MEASURED NOISE LEVELS (CHEENEY/LENOX) - JETS REMOVED					
Date	Source	Fluctuating Noise Levels (dBA)			Average (dBA)
		Min	Core Range	Max	
5/17/17	U2 Concert	50	56 – 64	70	**61**
9/21/17	49ers Game	45	51 – 62	76	**59**
7/26/17	CONCACAF Final	49	52 – 62	72	**58**
10/4/17	Coldplay Concert	44	48 – 60	75	**58**
11/5/17	49ers Game	48	52 – 60	77	**57**
10/22/17	49ers Game	47	51 – 59	77	**56**
11/12/17	49ers Game	46	51 – 58	75	**56**
7/23/17	CONCACAF Game	48	51 – 58	70	**55**
8/31/17	49ers Game (PS)	48	51 – 57	67	**54**
9/10/17	49ers Game	46	49 – 57	67	**54**
8/19/17	49ers Game (PS)	46	49 – 55	68	**53**

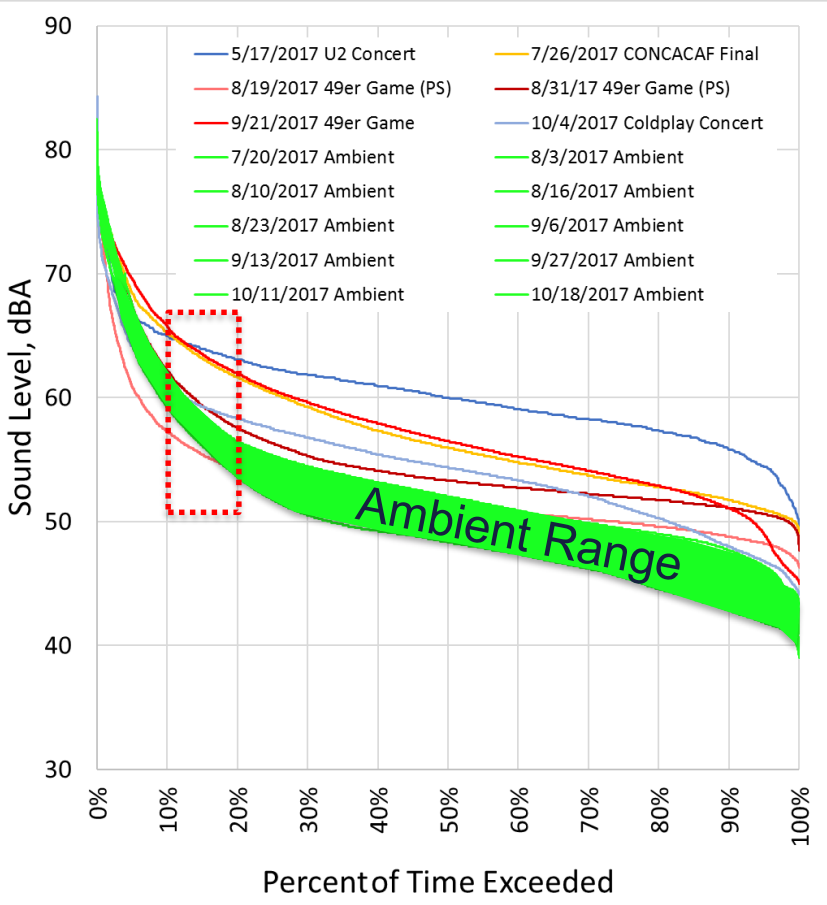
Levi's© Stadium Noise Monitoring

Noise Monitoring System Data – Daytime Events



Levi's© Stadium Noise Monitoring

Noise Monitoring System Data – Evening/Nighttime Events



Levi's© Stadium Noise Monitoring

SUMMARY – FORECAST, REGULATED, AND MEASURED NOISE LEVELS					
	EIR	Permit	U2	Coldplay	49er Games
dBA (1 hour avg)	61 - 66	60	61	58	53 - 59
Maximum	75		70	75	67 - 77
Core Range	55 – 68		56 - 64	48 - 60	48 - 62

Sound Levels in dBA at Southern Residential Neighborhood

Noise Monitoring – Wrap Up Comments

- Premature to make policy decisions
- In-person monitoring provides better data
- Neighborhood subject to significant ambient noise (aircraft)
- Noise Levels are less than forecast in EIR
- Development Permit Condition based on one hour average noise levels
- U2 concert exceeded Permit Condition “maximum target” by 1 dBA
- Coldplay concert was within target noise levels
- Development Permit -- Standard to interpret is TBD

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Study Session: Noise Monitoring

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The Center of What's Possible

Noise Monitoring – Next Steps

Recommendations

1. Clarify noise limits
2. Identify key Noise Monitoring System stations
3. Determine monitoring
4. Receive input on next steps regarding an enforcement program

Noise Fundamentals

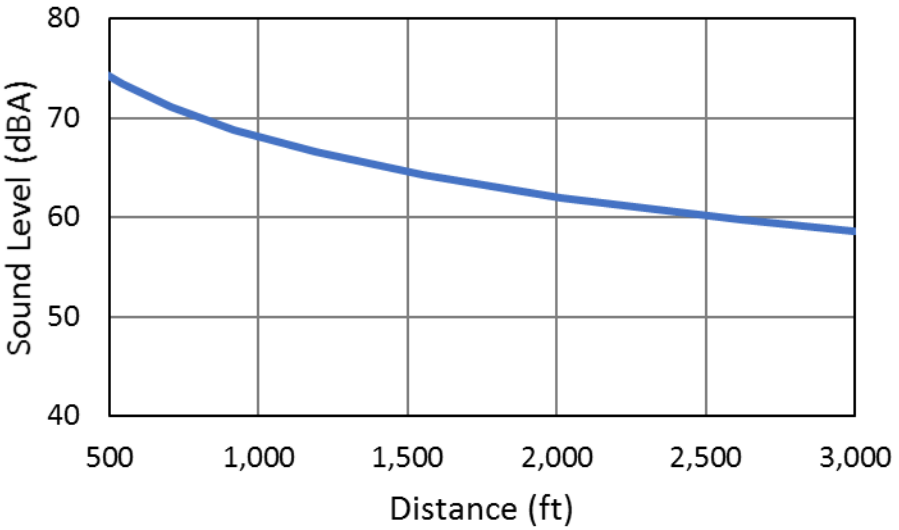
Sound Propagation:

- With distance
- Over sound barriers / Reverberation
- Inversion layer effect

Noise Fundamentals

Sound Propagation

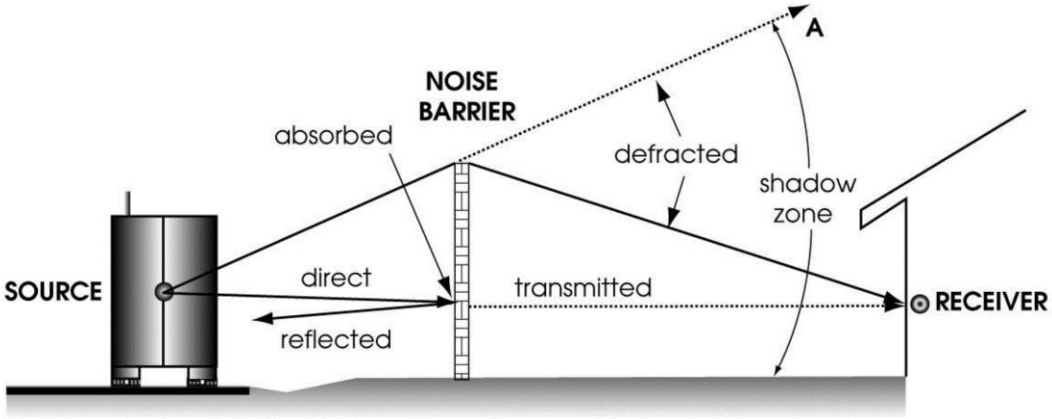
- With distance



Noise Fundamentals

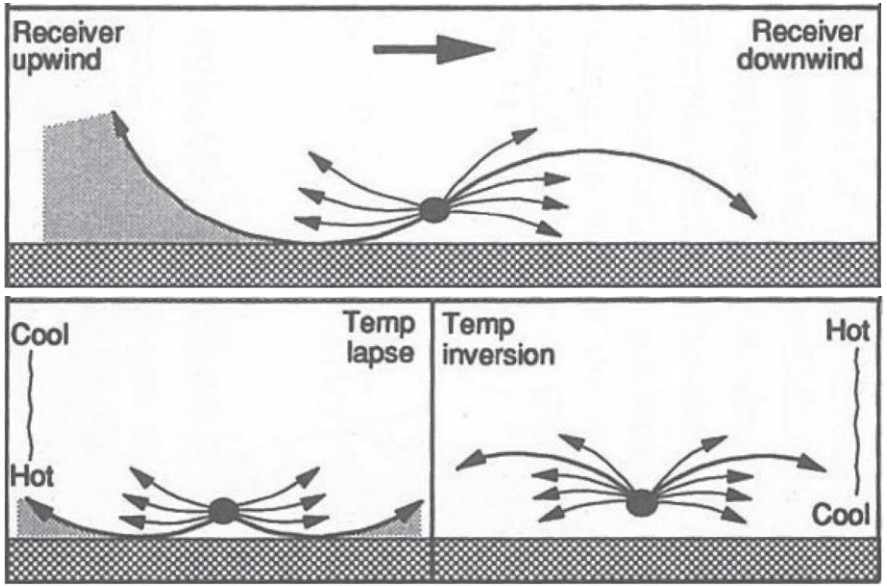
Sound Propagation

- Over Sound Barriers
  - 5 to 15 dB decrease
- Reverberation
  - Some increase



Noise Fundamentals

Sound Propagation – Inversion layer effect



Noise Regulation -- Citywide

City of Santa Clara General Plan Noise Element

- "Unacceptable noise is defined as a sound, or series of sounds, that are intrusive, irritating, objectionable and/or disruptive to daily life."
- Policy: 5.10.6-P3

New development should include noise control techniques to reduce noise to acceptable levels, including site layout (setbacks, separation and shielding), building treatments (mechanical ventilation system, sound-rated windows, solid core doors and baffling) and structural measures (earthen berms and sound walls).

Noise Regulation -- Citywide

City of Santa Clara General Plan Noise Element

- Based on dB CNEL: "a unit of measurement used to express the relative intensity of sound as heard by the human ear, averaged over a 24-hour period to estimate the community noise equivalent level"

General Plan Goals

- 5.10.6-G1 Noise sources restricted to minimize impacts in the community.
- 5.10.6-G2 Sensitive uses protected from noise intrusion.
- 5.10.6-G3 Land use, development and design approvals that take noise levels into consideration.

CEQA Noise Impact Assessment

Environmental Noise Analysis

- CEQA "Threshold of Significance"

  A **threshold of significance** for a given environmental impact defines the level of effect above which the Lead Agency will consider impacts to be **significant**, and below which it will consider impacts to be **less than significant**

- CEQA references local (e.g., City of Santa Clara) General Plan and Noise Ordinance standards

Levi's© Stadium Environmental Study

Environmental Impact Report (EIR) – February 2009 Noise Study

Significance Criteria

a) Do the dBA levels exceed the CSC Noise Ordinance limits?

b) Does the project increase the Ldn by more than 3?

c) Would the project result in noise levels 5 dBA greater than the existing ambient?

Levi's© Stadium Environmental Study

Draft Environmental Impact Report (DEIR) – July 2009

- High existing ambient neighborhood noise levels
  - 60 – 65 dBA daytime average
  - 75 – 85 dBA maximum (aircraft)
- Forecast neighborhood noise levels using data from Candlestick game
  - 61 – 66 dBA average (4 dBA above typical Sunday PM)
  - 68 dBA maximum (game noise)
  - Exceed typical median background noise levels by 19 – 24 dBA; Noticeably higher ambient noise levels during games

Levi's© Stadium Environmental Study

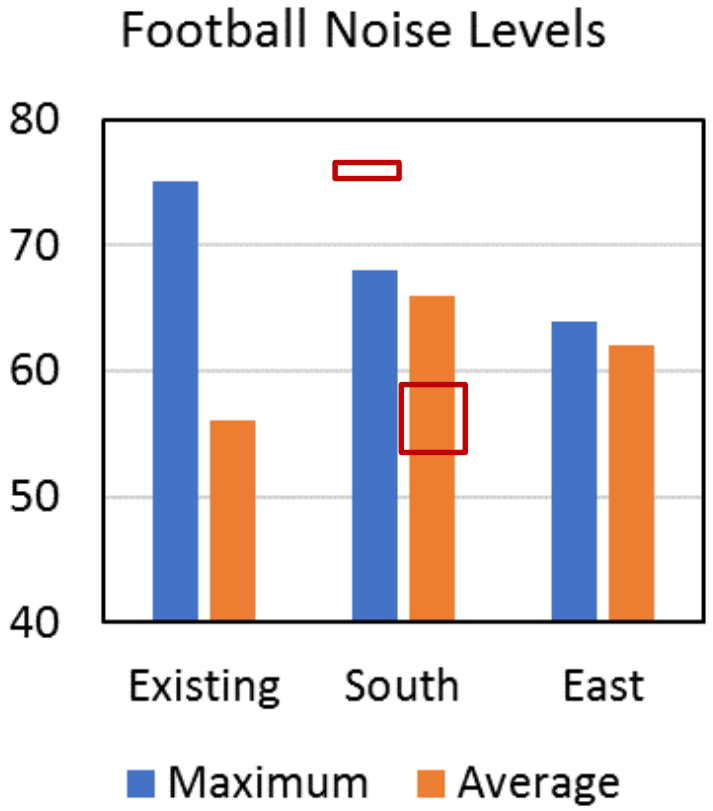
Draft Environmental Impact Report (DEIR) – July 2009

- Forecast for other events
  - 61 – 66 dBA average
  - 55 – 68 dBA typical maximum range
  - 4 dBA above typical
  - Exceed typical median background noise levels by 19 – 24 dBA
- Construction Noise Impacts

Levi's© Stadium Environmental Study

Environmental Impact Report (EIR)

February 2009 Noise Study

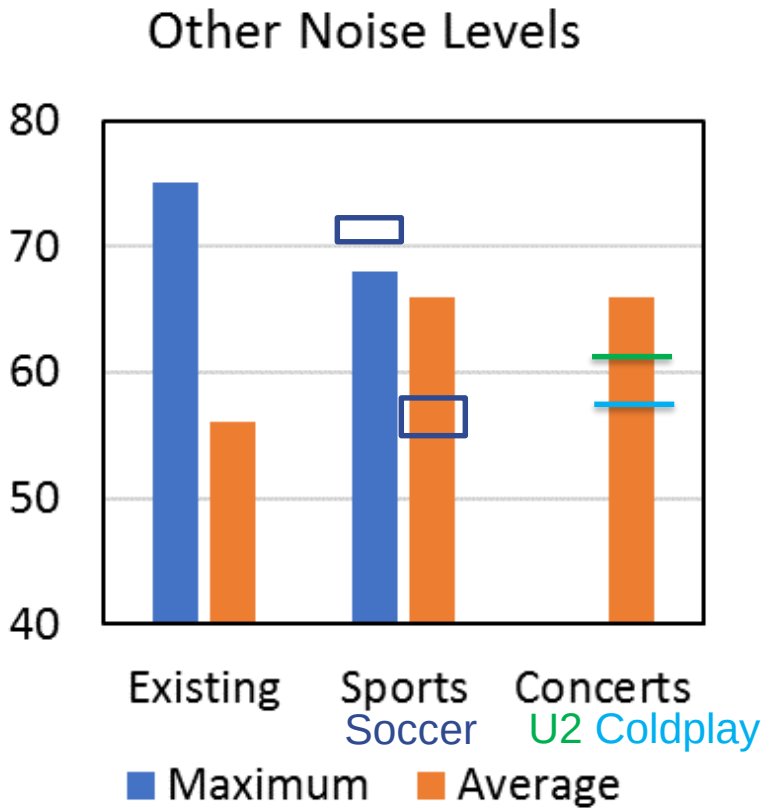


49ers Games 2017

Levi's© Stadium Environmental Study

Environmental Impact Report (EIR)

February 2009 Noise Study



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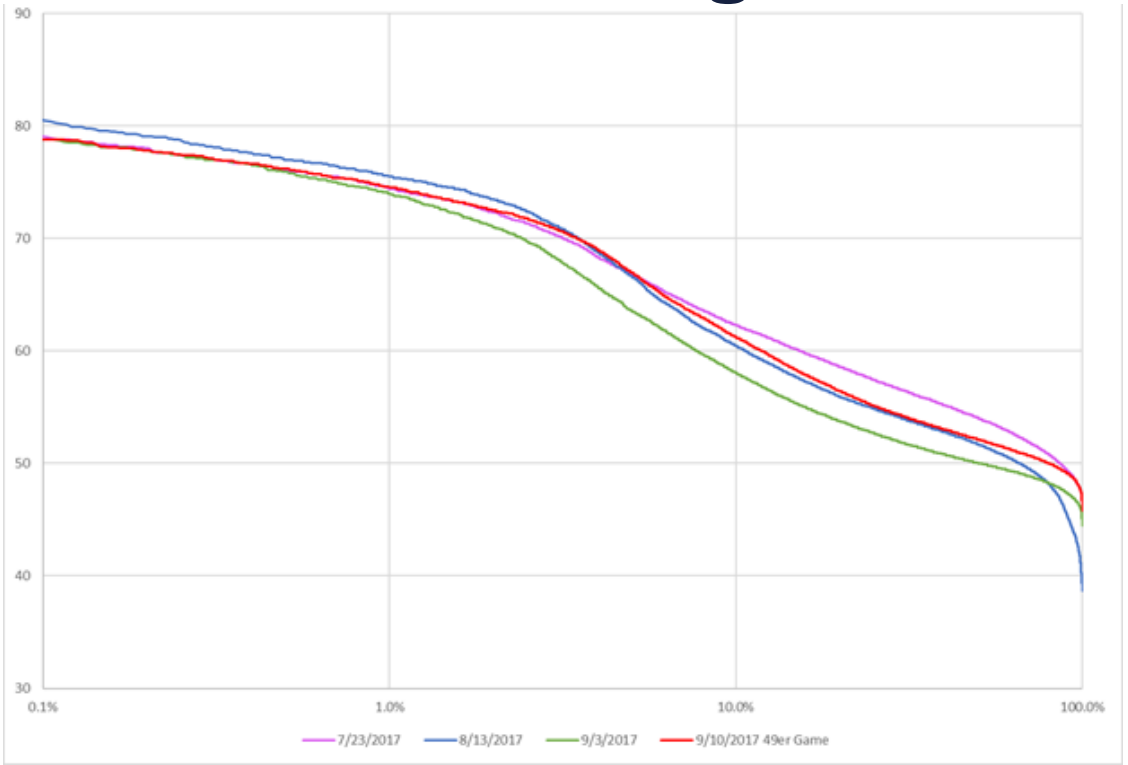
49ers Pre-season game
Cheeney & Lenox

Game noise levels (red) vs. typical ambient



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Coldplay Concert