Assessing the Effectiveness of Noise Ordinances on Residential Construction: A Case Study in San Luis Obispo

Duncan Catley
California Polytechnic State University
San Luis Obispo, California

Construction activities inherently generate substantial noise. As a result, construction becomes a notable source of ambient sound that permeates populated areas daily. This sound, especially at extreme volumes, can be the source of significant public annoyance and anger. Studies have shown that prolonged noise exposure can lead to hypertension, distraction, and even cognitive impairment in children. For these reasons, local governments will set noise ordinances to limit when and at what volume construction sounds can be made. The purpose of this study was to determine the effectiveness of these noise ordinances set by the city of San Luis Obispo. The effectiveness was gauged by the level of satisfaction of residents neighboring four distinct job sites. Interviews were conducted with neighbors and contractors. Additionally, decibel readings were taken at the jobs to determine contractor compliance with volume limits. All four jobs had readings well below the city limit of 75 dBA. Every neighbor that was interviewed had either a neutral or positive impression of the sound emitted from sites. Lastly, all four contractors were void of noise complaints. It can be reasonably concluded that the noise ordinances effecting residential construction in the city of San Luis Obispo are working as intended.

Key Words: Noise Ordinances, Sound Pollution, Residential Construction, Ambient Sound

Introduction

Construction, in general, is a noisy process. The employment of loud power tools, heavy machinery, and assembly mechanics make construction a significant contributor to the ambient sound heard in populated areas every day. This sound, especially at extreme volumes, can be the source of much public annoyance and distraction, especially in residential areas. On a tight schedule, a contractor may even perform work at night which would further irritate the public. Long-term exposure to high levels of noise has been correlated with various adverse public health outcomes. The effects of noise pollution on public health have been the subject of extensive scientific inquiry, revealing a wide range of adverse outcomes that can extend beyond immediate discomfort. Chronic exposure to noise has been associated with numerous physical and psychological health issues, including cardiovascular diseases, mental health disorders, developmental impairments, and reduced overall quality of life. Understanding these long-term consequences is essential for informing evidence-based interventions and policies that protect and promote public health in an increasingly noisy world.

To minimize public annoyance, municipalities will establish codes and ordinances to restrict when certain construction practices occur and at what permissible volume. Noise ordinances can be traced back to Julius Cesar who in 44 BC restricted the use of wagons “after sunrise or before the tenth hour of the day” (Pharr et al., 1961, para. 14). Ambient noise volumes have only increased, especially after

the dawn of the industrial revolution. Due to the inevitability of construction and subsequent sound pollution, ordinances typically allow work during the day and restrict work at night with some variability depending on the sound source. There exists yet more variability depending on the location of work. In locations where the ambient sound volume is high, such as in a big city, sound produced from the site can be permissibly higher. The inverse exists for low density areas such as small towns.

The Effects of Sound Pollution on Public Health

There have been numerous studies indicating that noise pollution emitting from airports has detrimental effects on children's cognition and memory. One study by Stansfeld et al. (2005) found the exposure to aircraft noise can be associated with detrimental effects on children's cognitive functions, particularly in areas such as reading comprehension, long-term memory, and motivation. Tasks involving central processing and language comprehension, such as reading, attention, problem-solving, and memory, appear to be significantly affected by noise exposure. The study concluded that "Schools exposed to high levels of aircraft noise are not healthy educational environments" (p. 1942). Further, another study by Glass and Singer (1972, as cited by Stansfeld & Matheson, 2003) found that with adults, "tasks performed during noise were unimpaired but tasks that were carried out after noise had been switched off were impaired, this being reduced when subjects were given perceived control over the noise. Indeed, even anticipation of a loud noise exposure in the absence of real exposure may impair performance" (pg. 245). This finding is especially important in the context of this case study as construction jobsites generally produce loud intermittent sounds which would hinder the performance of tasks.

A study conducted by Babisch (2006) found sufficient evidence that noise pollution emitting from traffic and aircraft can lead to increased rates of hypertension and ischemic heart disease in adults. Furthermore, a Swedish study found "The prevalence of hypertension was found to be higher among subjects exposed to time weighted energy averaged aircraft noise levels of at least 55 dBA, or maximum levels above 72 dBA occurring at least three times during the average 24 hour period in 1 year" (Rosenlund, 2001, pg 772). Figure 1 displays the results of the study.

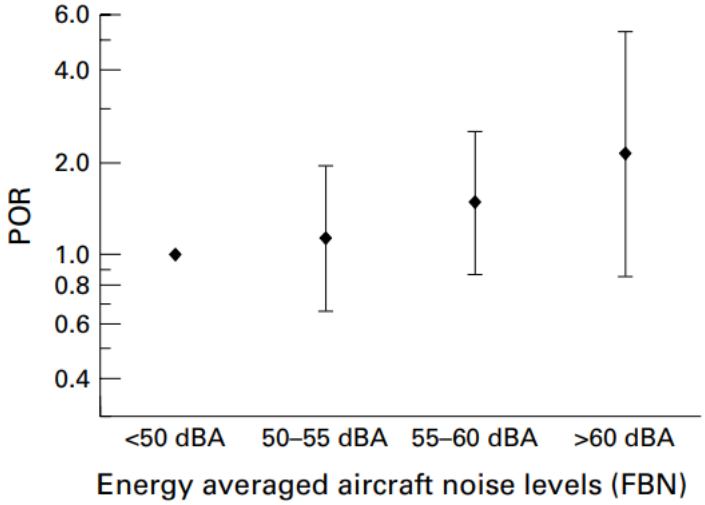

Figure 1. Risk for hypertension in different categories of equal energy aircraft noise levels
Source: (Rosenlund, 2001, pg 772).

The prevalence odds ratio (POR) quantifies the increased likelihood of exposure among individuals with the condition of interest (case-patients) compared to those without the condition (controls). A POR of one indicates there is no increase in exposure and a POR of more than one indicates a statistically relevant increase in exposure. As you can see, at less than 50dBA there is no increase in hypertension whereas at greater than 60 dBA there is a significant increase in the likelihood of hypertension.

San Luis Obispo City Ordinances

To minimize public health effects and annoyance caused by noise pollution, the city of San Luis Obispo has set ordinances to govern when and at what volume sound can be produced. Through zoning plans, San Luis Obispo is able control with more specificity where exactly certain noise producing activities can occur. For the purpose of this case study, focus will be placed on construction activities occurring in residentially zoned areas. The most impactful of these ordinances is when work can legally be performed. Under prohibited acts, San Luis Obispo forbids "Operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration or demolition work between weekday hours of seven p.m. and seven a.m., or any time on Sundays or holidays, such that the sound therefrom creates a noise disturbance across a residential or commercial real property line, except for emergency work of public service utilities or by exception issued by the community development department" (9.12.050 Prohibited Acts, n.d.). This code prevents construction from being performed at night, which would be a significant source of public annoyance and sleep deprivation. Moreover, unplanned work during permitted hours at single family residences cannot surpass 75dBA at the property line. Unplanned work is the utilization of mobile equipment that produces short term intermittent sound. Regarding long term, planned work, utilizing stationary equipment, maximum noise levels may not surpass 60dBA.

Efforts to Mitigate Sound from Construction Sites

The Laborers' Health and Safety Fund of North America (LHSFNA) has a published list (Controlling Noise on Construction Sites Controlling Construction Noise, n.d.) that spells out a wide range of sound mitigation tactics that, when employed, reduce sound permeating out beyond the bounds of the jobsite. The use of sound barriers (see Figure 2), according to LHSFNA can lower a sound of 105 dBA to just 84dBA at 40 feet away. Sound barriers are a feasible option for contractors to employ as they can be constructed from readily available materials from around the jobsite. Another technique spelled out by LHSFNA is utilizing newer, quieter generators. Because construction sites for some time, won't have a permanent power supply, loud generators are a common source of sound pollution on sites. According to Controlling Noise on Construction Sites Controlling Construction Noise (n.d.), "Newer heavy duty diesel generators are designed to emit low noise and vibration. Some units are up to 15 dB (A) quieter than older diesel-powered generators and quieter than most gasoline sets" (pg. 7). Another related mitigation tactic highlighted in the publication is to replace the exhaust systems of all heavy machinery. This may be hard for a contractor to financially justify but there are significant decibel reductions associated with this.

Figure 2. Sound Barriers
Source: (Construction Noise Barrier, n.d.)

Figure 3. Minetek's Caterpillar exhaust
Source: (Caterpillar Exhausts & Mufflers, n.d.)

Methodology

The objective of this study is to gauge the effectiveness of noise ordinances set by the city of San Luis Obispo on residential construction. The effectiveness of these ordinances was to be determined by the level of public annoyance adjacent to various sites in addition to contractor compliance with the law. To achieve a representative understanding of the effectiveness of city ordinances, four active residential job sites were picked at random around the city (See Figure 4). Interviews were conducted with both neighbors and contractors to obtain qualitative data on the subject. One representative from each contractor was interviewed and 2-3 neighbors were interviewed from both across the street and directly bordering the job. In all 10, neighbors were interviewed, and four contractors were interviewed. Contractor interviews were conducted during the workday and neighbor interviews were conducted in the evening for the best chance of a response.

Interview questions for the contractors are as listed:

- Have you received a noise complaint or citation at this job?
- Have you received a noise complaint or citation at any job you have performed?
- Have you taken any special measures to mitigate sound pollution at this job?

Interview questions for the neighbors are as listed:

- Have you had any annoyance with sound emitting from the construction job adjacent to your residence?
- Do you have any general complaints about the construction practices at the jobsite?

Additionally, decibel readings were taken at property lines of the jobs. The purpose being to compare acquired readings to the city stipulated volume maximums to gauge contractor compliance. To garner the best representative data, volume readings were taken in the midmorning, before lunch.

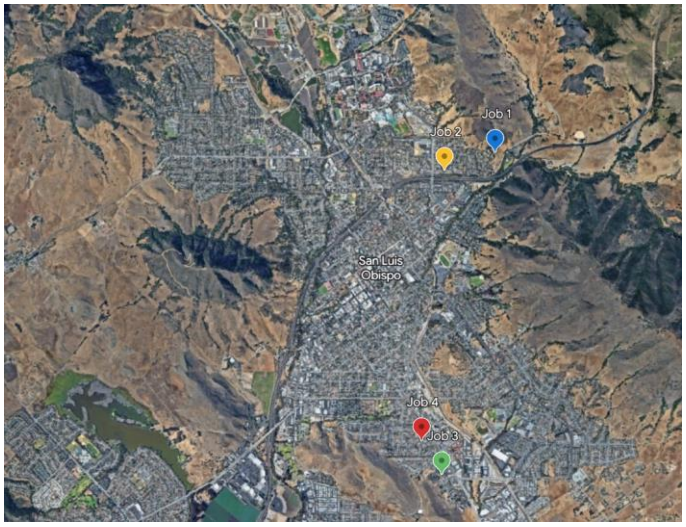

Figure 4. Locations of the four jobs surveyed

Results

The findings of this survey and data collection were encouraging for the San Luis Obispo municipality and for the contractors alike. To begin, regarding maximum decibel levels at single family residences, all four jobsites emitted sound well below the city stipulated maximums. Job one through four emitted 57dBA, 56dBA, 52dBA, and 57dBA respectively. As mentioned earlier, the city of San Luis Obispo prohibits sound above 75dBA for non-stationary equipment (all four jobs fell into this category). As for neighbor feedback, all interviewees displayed either a neutral or positive stance on the sound emitted from their neighboring jobsite. One interviewee exclaimed, “It’s noisy but to be expected”. Another said, “Well they don’t work at night, so I suppose it’s OK”. None of the 10 interviewees reported being explicitly annoyed with the jobsite. To determine if there were any missing neighbors that did in fact have issues with their neighboring job, contractors were asked if they themselves had received a complaint or citation on their job. All contractors said they hadn’t. Contractors were subsequently asked if they had been employing any mitigation techniques to reduce sound pollution from their site. None of the four reported employing any sort of reduction measures. One contractor notably said, “It’s business as usual”. Lastly, contractors were asked if they’ve ever had a noise complaint or citation. One contractor mentioned that San Luis Obispo, in general, is tolerant of construction sounds but there is more strife in Pismo Beach.

Discussion

The contractor on Job 3 had some valuable insight after being interviewed. They highlighted that there are only a few phases of residential construction that are significantly loud. The phases mentioned were sitework, foundation work, and framing. Furthermore, due to the limited size of single-family homes, each phase doesn’t take much more than a week to complete so in total there are maybe four weeks of relatively loud sounds emitting from the construction site. The contractor speculated that the lack of noise complaints in San Luis Obispo could be a side effect of the limited time neighbors are exposed to construction sounds. There are other variables that could be contributing to neighborly satisfaction with construction practices such as jobsite proximity. One contractor interviewed mentioned that San Luis Obispo, in general, is tolerant of construction sounds but there is more strife in Pismo Beach. A job set in a densely packed area, such as Pismo Beach, may be the victim of less neighborly satisfaction.

Regardless of these possible explanations, it is reasonably concluded that the noise ordinances governing residential construction in San Luis Obispo are effective in maintaining public satisfaction and reducing health effects. Future research should be conducted to see whether or not the San Luis Obispo sound ordinances governing commercial construction have the same positive effect on neighbors. This would be particularly interesting because contractors performing the work would be neighboring businesses who are concurrently performing work. It would be enlightening to see how a business responds to construction job right next door.

References

Babisch, W. (2006). Transportation noise and cardiovascular risk: Updated Review and synthesis of epidemiological studies indicate that the evidence has increased. *Noise and Health*, *8*(30), 1. https://doi.org/10.4103/1463-1741.32464

Caterpillar Exhausts & Mufflers. (n.d.). Minetek. Retrieved June 15, 2023, from https://minetek.com/sound/caterpillar-exhausts/

Construction Noise Barrier. (n.d.). Www.epd.gov.hk. https://www.epd.gov.hk/epd/misc/construction_noise/contents/index.php/en/home2/mitigation-measures/item/157-construction-noise-barrier.html

Controlling Noise on Construction Sites Controlling Construction Noise. (n.d.). https://www.lhsfna.org/LHSFNA/assets/File/bpguide%202014.pdf

9.12.050 Prohibited acts. (n.d.). San Luis Obispo Municipal Code. Retrieved June 14, 2023, from https://sanluisobispo.municipal.codes/Code/9.12.050

Pharr, C., Johnson, A. C., Coleman-Norton, P. R., & Bourne, F. C. (1961). *Ancient Roman statutes : translation, with introduction, commentary, glossary, and index*. Avalon.law.yale.edu. https://avalon.law.yale.edu/ancient/law_of_caesar.asp

Rosenlund, M. (2001). Increased prevalence of hypertension in a population exposed to aircraft noise. *Occupational and Environmental Medicine*, *58*(12), 769–773. https://doi.org/10.1136/oem.58.12.769

Stansfeld, S. A., & Matheson, M. P. (2003). Noise pollution: Non-auditory effects on health. *British Medical Bulletin*, *68*(1), 243–257. https://doi.org/10.1093/bmb/ldg033

Stansfeld, S., Berglund, B., Clark, C., Lopez-Barrio, I., Fischer, P., Öhrström, E., Haines, M., Head, J., Hygge, S., van Kamp, I., & Berry, B. (2005). Aircraft and road traffic noise and children's cognition and health: a cross-national study. *The Lancet*, *365*(9475), 1942–1949. https://doi.org/10.1016/s0140-6736(05)66660-3