

# Construction Industry Noise Exposures Electricians

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# Introduction

Many construction workers complain that they can't hear as well as they used to, and statistics back them up. Electricians and other construction workers are exposed to noises loud enough to cause permanent noise-induced hearing loss. In Washington state, construction workers are five times more likely to file workers' compensation claims for hearing loss than are workers in all occupations combined.

This report from the University of Washington looks at the noise exposures of electricians and makes recommendations applicable to their specific needs. It is based on six years of research in the construction trades. Since 1997, university researchers have collected information on noise exposures of construction workers in the Puget Sound area. We now have almost 900 full-shift measurements on workers from 11 trades, including 210 measurements on electricians.



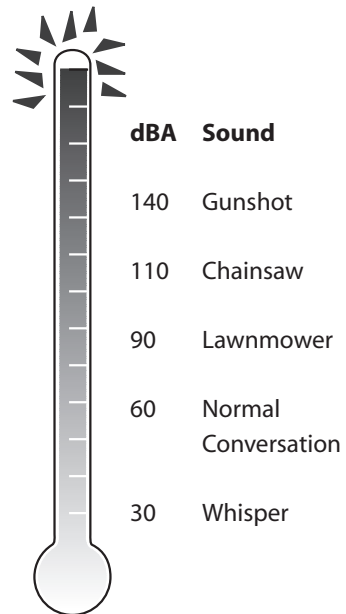
## What is noise?

Noise is unwanted sound. Noise levels are measured on a decibel scale (dBA), which matches the ear's sensitivity to sound. A whisper is about 30 dBA, normal conversation is 60–70 dBA, and power tools are often between 90–110 dBA. If two people at arm's length must raise their voices to be heard, the noise level is above 85 dBA. Figure 1 shows the decibel levels of some familiar sounds.

## Safe noise levels

Our noise measurements are based on the legal noise standard of the Washington Industrial Safety and Health Act (WISHA). In Washington state, the Permissible Exposure Limit (PEL) allows an 8-hour, full-shift average exposure of 85 dBA.\* For every 5 dBA increase above this level, the allowable exposure time is cut in half (see figure 2 on page 3). Workers with a full-shift average exposure above 85 dBA are required to wear hearing protection devices (either earplugs or earmuffs). They also must be included in a hearing conservation program in which they receive annual hearing tests and training on noise exposure and hearing loss. Workers must *always* use hearing protection when levels exceed 115 dBA.

**Figure 1.**  
**Decibel levels (dBA)**  
**of familiar sounds**

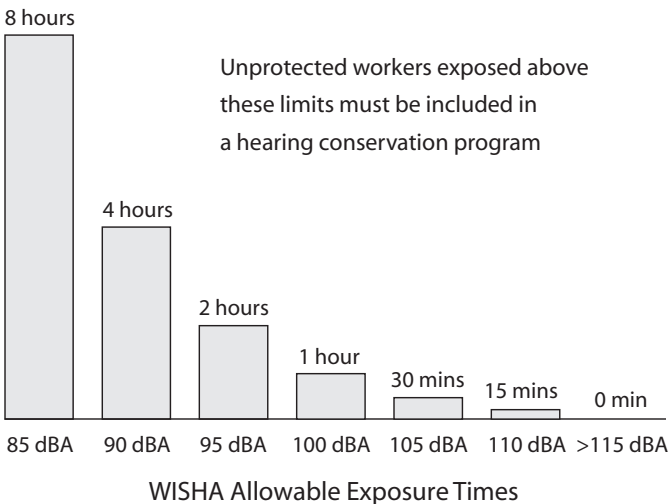


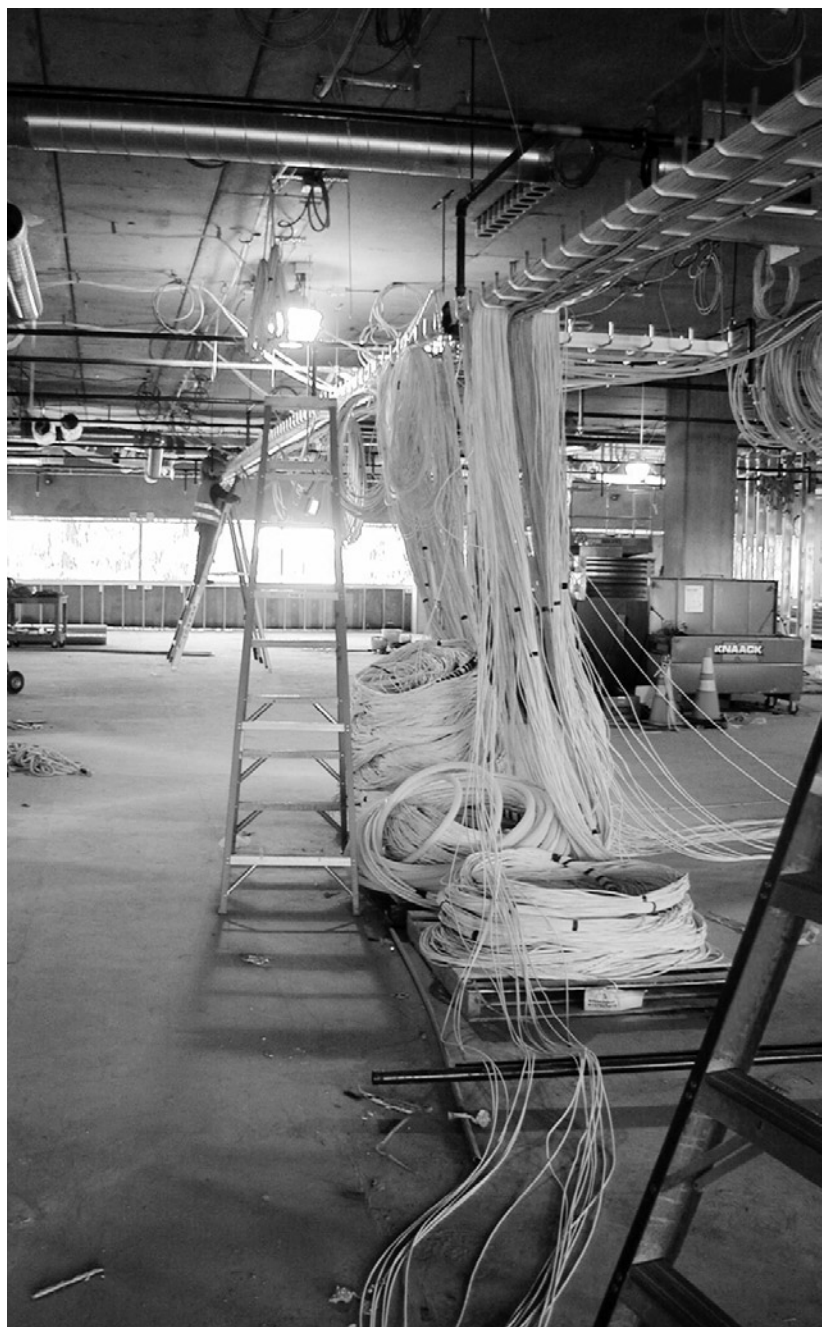
\* The federal Occupational Safety and Health Administration (OSHA) PEL for construction noise is an eight-hour average of 90 dBA.

### What happens if you are exposed to too much noise?

Noise exposures that are loud enough and last long enough can damage nerves in the inner ear, causing permanent and irreversible hearing loss. This damage can result from repeated exposure to levels above 85 dBA (such as years of working around construction noise without hearing protection), or from as little as one exposure above 140 dBA. Workers who have suffered hearing loss often become socially isolated because they can't communicate easily with others. They also may not be able to hear warning signals, which can lead to accidents and injuries. Our measurements show that most construction tasks and tools generate noise levels that require use of hearing protection. However, we found many situations in which workers rarely or never use hearing protection. This gap in hearing protector use puts electricians at risk for hearing loss.

**Figure 2. WISHA allowable noise exposures**





# What we found in our research

Of the 887 full-shift noise measurements we made, 210 were on electricians. The majority were from commercial construction sites, with the remainder from industrial, residential, road, bridge, and high-way work sites. The type and size of work sites are important factors in noise levels. The largest sites generally have the highest exposure levels.

## Average noise exposures and hearing protector use for electricians

Table 1 shows information from our full-shift measurements on electricians. The average level measured was 79.9 dBA. However, one in five measurements was above 85 dBA, the WISHA 8-hour allowable limit. Above this level, hearing protectors are required. Very few measurements were above 90 dBA. We found that electricians used hearing protectors only 18% of the time that their exposure levels were above 85 dBA. Over one-third of all measurements also included exposure above 115 dBA. Even though hearing protectors are always required above 115 dBA, they were used only about 15% of the time. One possible reason that hearing protectors were used less at 115 dBA than at 85 dBA is that very high exposure levels are usually shorter in duration than lower levels, so workers may not have enough time or warning to put on hearing protectors.

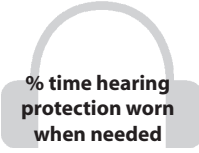
**Table 1. Work shift noise level information on 210 electricians**

Category	Result
Average full-shift noise level	79.9 dBA
Average length of measured work shifts	8 hr 26 min
% of full-shift average levels above 85 dBA	20%
% of full-shift average levels over 90 dBA	4%
% of work shifts with any noise above 115 dBA	37%
Average % time hearing protectors used above 85 dBA	18%
Average % time hearing protectors used above 115 dBA	15%

## Task and tool exposures for electricians

We measured noise levels for each task reported by electricians, along with the percent of time that they used hearing protectors when levels were above 85 dBA (see table 2). Every task (except operating work vehicle and sheet metal work) had an average level above 85 dBA, meaning that workers should have worn hearing protection. Similarly, we measured noise levels for the tools that electricians reported using (see table 3 on page 7). Although noise levels exceeded 85 dBA for

**Table 2. Tasks, in order of increasing average noise level**




Tasks	Average noise level (dBA)	Maximum noise level (dBA)	% time hearing protection worn when needed
Operating Work Vehicle	79.2	103.0	0%
Sheet Metal Work	81.6	99.3	NA
Manual Material Handling	86.5	109.6	1%
Panel Wiring, Installing Fixtures	87.0	109.2	66%
Break, Rest, Lunch, Cleanup	87.0	99.8	7%
"Other" Tasks	90.5	110.9	12%
Installing Slab Conduit	91.0	115.4	15%
Installing Wall Conduit	91.1	115.4	18%
Installing Cable Tray	91.8	112.8	0%
Pulling Wire	95.6	113.1	2%
Installing Trench Conduit	95.8	118.6	0%



every tool used (except other hand power tools), electricians didn't always report using hearing protection. In fact, workers *never* used hearing protection while using hand power saws, chopsaws, other hand power tools, or hammers and sledges. None of the tasks or tools had an *average* noise level above 115 dBA, which would require use of hearing protectors, no matter how short the exposure. In both tables, "NA" indicates hearing protector use was not evaluated.

**Table 3. Tools, in order of increasing average noise level**



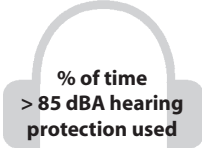
Tools	Average noise level (dBA)	Maximum noise level (dBA)	% time hearing protection worn when needed
Other Hand Power Tool	84.4	103.6	0%
Screw Gun, Drill Motor	86.3	109.3	9%
No Tool	86.6	101.6	9%
"Other" Tools	87.1	112.1	100%
Hand Power Saw	88.0	102.4	0%
Rotohammer	89.2	108.3	39%
Chopsaw	90.7	113.7	0%
Hammer, Mallet, Sledge	91.8	111.0	0%
Chipping Gun	94.2	112.7	NA
Powder Actuated Tool	103.0	112.8	NA

### Noise exposures for all trades

The average full-shift noise exposure level for *all workers in all trades* was 81.4 dBA. The percentage of full-shift measurements by trade that exceeded the WISHA 8-hour allowable limit of 85 dBA is shown in Table 4. The trades with the most exposures above the WISHA limit were operating engineer and cement mason (46% of full-shift measurements were above 85 dBA), while sheet metal workers had the fewest exposures above the WISHA limit (11% above 85 dBA).

The trade with the highest average work shift exposure was operating engineer (84.6 dBA); insulation workers had the lowest average work

**Table 4. Percent of work shifts above WISHA 8-hour standard (in order of increasing percentages), percent of time hearing protection was used above 85 dBA, and average full shift noise level (by trade)**

Trade	% of 8-hour work shifts > 85 dBA	 % of time > 85 dBA hearing protection used	Average full-shift noise level (dBA)
Sheet Metal Worker	11%	66%	79.0
Insulation Worker	18%	14%	75.3
Tilesetter	20%	12%	76.0
► <b>Electrician</b>	<b>20%</b>	<b>18%</b>	<b>79.9</b>
Bricklayer	26%	49%	82.6
Masonry Restoration	37%	56%	82.7
Carpenter	40%	43%	82.2
Ironworker	40%	13%	82.9
Laborer	44%	NA	83.6
Cement Mason	46%	8%	79.3
Operating Engineer	46%	70%	84.6
<b>All Trades</b>	<b>34%</b>	<b>39%</b>	<b>81.4</b>

shift exposure (75.3 dBA). About one-third of full-shift measurements for all trades were above the WISHA limit for workers not using hearing protectors. Even “quiet” trades such as electricians and insulation workers sometimes had full-shift measurements that were above the WISHA limit. Overall, workers in all trades reported using hearing protection less than 40% of the time they were exposed above 85 dBA, and about one-third of the time they were exposed at the much higher level of 115 dBA. Operating engineers had the highest use of hearing protection and cement masons had the lowest. For laborers, “NA” means hearing protection use was not evaluated.



# How electricians can prevent hearing loss

Construction workers in *all* of the trades we examined have the potential for high exposure to noise. Although construction workers make up only 7% of the Washington state workforce, they file more than 21% of all accepted workers' compensation hearing-loss claims. The preferred way to prevent hearing damage is to reduce noise at its source. However, earplugs and earmuffs will always be necessary for some construction activities.

One in five full-shift average measurements on electricians was above the WISHA standard for an 8-hour noise exposure. Unfortunately, electricians used hearing protection only about 18% of the time they were exposed above 85 dBA, and 15% of the time they were exposed above 115 dBA. Electricians often got more noise exposure from activities going on around them than they did from their own work, and need to consider nearby activities as well as their own when choosing hearing protection.

## Recommendations

Educational programs can help make electricians aware that almost all activities on the job site—including breaks and eating lunch—have potentially hazardous noise levels. All electricians in the construction industry should be enrolled in a hearing conservation program, and efforts should be made to reduce the noise levels of construction activities and to increase the use of hearing protection.

All hearing protectors are labeled with a Noise Reduction Rating (NRR), which is a laboratory estimate of how much noise the hearing protector will block. Typically, the NRR level is about two times higher than the protection most workers experience in actual use.

Almost all full-shift noise exposure measurements on electricians were below 90 dBA. To adequately protect against these average noise levels, we recommend hearing protectors with an NRR of 12 dB. For most activities, an NRR higher than this will provide too much

protection, interfering with normal communication and work. Workers who find that hearing protectors with a very high NRR (33 dB is the highest available) make it difficult to hear regular work sounds should try a different hearing protector with a lower NRR. On the other hand, workers exposed to very high levels of noise should use a hearing protector with a higher NRR. Workers exposed to intermittent noises should consider using earmuffs or banded earplugs, which can be removed and inserted quickly. A single type of hearing protector *will not* work for all workers and all exposure levels, so it is important to have several types and styles of hearing protectors available.

### **Summary**

Almost all of the measured construction tasks exposed electricians to noises above 85 dBA, loud enough to warrant use of hearing protection. Some of the noisiest tasks—installing slab conduit, wall conduit, and trench conduit—involved occasional exposures above 115 dBA, a level at which hearing protection is *always* required. We found that actual use of hearing protection ranged from never to 66% of the time, depending on task.

Likewise, all but one of the construction tools we measured exposed workers to noise levels above 85 dBA. Electricians often did not use hearing protection with the measured tools. However, they *always* used hearing protection with “other” tools.

Workers exposed to loud noises without use of hearing protection risk losing their hearing. Properly worn hearing protection can prevent this loss. Training on the proper use of hearing protection is an important part of a hearing conservation program, and should take into account the need for construction workers to hear warning shouts and signals. In addition to providing hearing protectors and training, construction companies should look into reducing noise exposure levels by purchasing quieter equipment or shielding workers from the noisiest equipment.

## **For additional information**

### **About the UW study and its results**

University of Washington *Occupational Noise* Web site:

<http://depts.washington.edu/occnoise>

or contact the Field Research and Consultation Group at 206-543-9711

or [cnstsafe@u.washington.edu](mailto:cnstsafe@u.washington.edu)

### **For more information about noise and its effects on hearing**

NIOSH web page: <http://www.cdc.gov/niosh/topics/noise/>

or WISHA hearing conservation web site:

<http://www.lni.wa.gov/Safety/Topics/AtoZ/NoiseHearing/default.asp>

### **For assistance in developing a hearing conservation program**

Contact the WISHA consulting service for the nearest consultant

<http://www.lni.wa.gov/Safety/KeepSafe/Assistance/Consultation/default.asp>

or call 800-547-8367

Or contact Build It Smart, a local labor/management organization

for the construction industry, at [www.builditsmart.org](http://www.builditsmart.org)

or 360-596-9200

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