



# Construction Industry Noise Exposures Carpenters

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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. Carpenters 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 carpenters 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 174 measurements on carpenters.



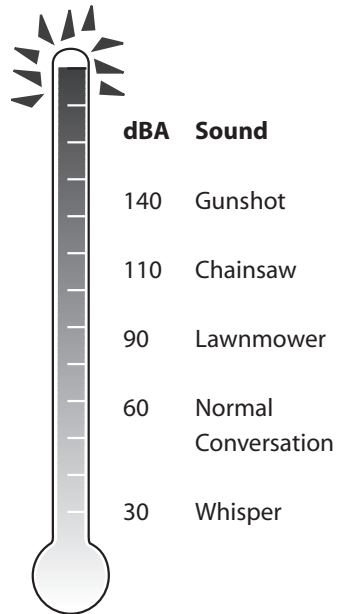
## What is noise?

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**

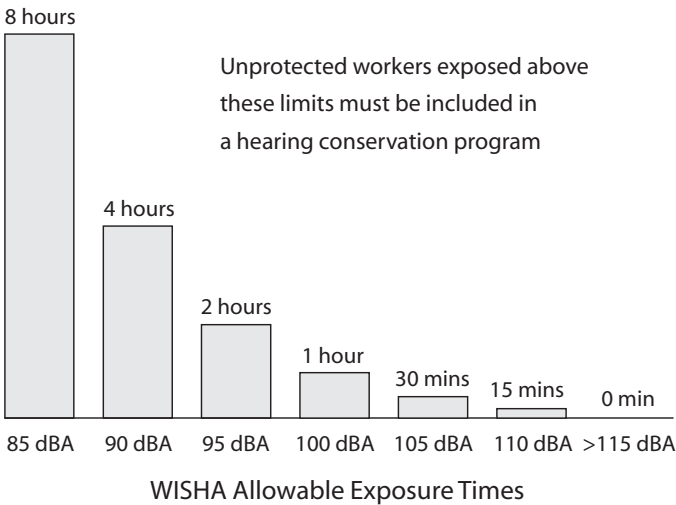


\* The federal Occupational Safety and Health Administration (OSHA) PEL for construction noise is an eight-hour average of 90 dBA.

## 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 used hearing protection. This gap in hearing protector use puts carpenters at risk for hearing loss.

**Figure 2. WISHA allowable noise exposures**





# What we found in our research

Of the 887 full-shift measurements we made, 174 were on carpenters. The majority were from commercial construction sites, with the remainder from industrial, residential, road, bridge, and highway 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 carpenters

Table 1 shows information from our full-shift measurements on carpenters. The average level measured was 82.2 dBA. However, nearly half of all measurements were above 85 dBA, the WISHA 8-hour allowable limit. Above this level, hearing protectors are required. About one in ten measurements was above 90 dBA. We found that carpenters used hearing protectors only about half of the time that their exposure levels were above 85 dBA. More than half of all measurements also included exposure above 115 dBA. Even though hearing protectors are always required above 115 dBA, they were used only about one-third 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.

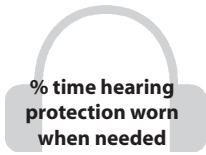
**Table 1. Work shift noise level information on 174 carpenters**

Category	Result
Average full-shift noise level	82.2 dBA
Average length of measured work shifts	8 hr 25 min
% of full-shift average levels above 85 dBA	40%
% of full-shift average levels over 90 dBA	13%
% of work shifts with any noise above 115 dBA	54%
Average % time hearing protectors used above 85 dBA	43%
Average % time hearing protectors used above 115 dBA	36%

## Task and tool exposures for carpenters

We measured noise levels for each task reported by carpenters, along with the percent of time that they used hearing protectors when levels were above 85 dBA (see Table 2). Almost every task (including breaks, lunch, and cleanup) had an average level above 85 dBA, meaning that workers should have worn hearing protection. Similarly, we measured noise levels for the tools that carpenters reported using (see Table 3 on page 7). Although noise levels exceeded 85 dBA for every tool used,

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

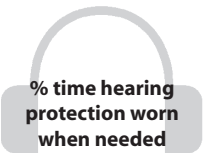


Tasks	Average noise level (dBA)	Maximum noise level (dBA)	% time hearing protection worn when needed
Operating Work Vehicle	80.1	102.4	0%
Break, Rest, Lunch, Cleanup	87.8	106.4	28%
Shop Work	88.8	108.2	27%
Interior Finish	89.4	111.7	24%
Manual Material Handling	89.4	111.9	36%
Layout	90.5	109.5	14%
Wood Framing	91.0	116.8	30%
Building Forms	92.9	117.1	62%
Stripping Forms	94.8	126.5	NA
Welding	94.9	122.8	NA
"Other" Tasks	95.3	119.1	52%



carpenters didn't always report using hearing protection. In fact, workers almost *never* used hearing protection while using stationary power tools or "other" tools. 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**



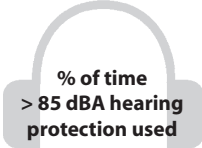
<b>Tools</b>	<b>Average noise level (dBA)</b>	<b>Maximum noise level (dBA)</b>	<b>% time hearing protection worn when needed</b>
No Tool	89.1	109.5	38%
Other Hand Power Tool	90.1	113.0	11%
Powder Actuated Tool	90.7	112.9	100%
Stationary Power Tool	91.3	106.4	3%
Hammer, Mallet, Sledge	91.6	118.8	48%
Chopsaw	92.0	112.5	85%
Hand Power Saw	92.3	115.6	38%
Screw Gun, Drill Motor	92.5	112.9	48%
"Other" Tools	93.1	116.4	0%
Welding, Cutting Equipment	94.9	122.8	NA
Rotohammer	95.1	119.6	53%

## 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 over 85 dBA), while sheet metal workers had the fewest exposures above the WISHA limit (11% over 85 dBA).

The trade with the highest average work shift exposure was operating engineer (84.6 dBA), and 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
Electrician	20%	18%	79.9
Bricklayer	26%	49%	82.6
Masonry Restoration	37%	56%	82.7
▶ <b>Carpenter</b>	<b>40%</b>	<b>43%</b>	<b>82.2</b>
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 carpenters 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.

Almost half of all full-shift average measurements on carpenters were above the WISHA standard for an 8-hour noise exposure. Unfortunately, carpenters used hearing protection only about half the time they were exposed above 85 dBA, and one-third of the time they were exposed above 115 dBA. Carpenters 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 carpenters aware that almost all activities on the job site—including breaks and eating lunch—have potentially hazardous noise levels. All carpenters 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 carpenters were below 92 dBA. To adequately protect against these average noise levels, we recommend hearing protectors with an NRR of 14 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 carpenters to noises above 85 dBA, loud enough to warrant use of hearing protection. The noisiest tasks—stripping forms, welding, building forms, and wood framing—involved occasional exposures above 115 dBA, a level at which hearing protection is *always* required. We found that use of hearing protection ranged from never to 62% of the time, depending on task.

Likewise, all of the construction tools we measured exposed workers to noise levels above 85 dBA with the loudest—welding and cutting equipment, rotohammers, hand power saws, and hammers and sledges—sometimes exceeding 115 dBA. The carpenters we studied almost always used hearing protection with powder actuated tools and chop saws, but used it half the time or less 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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