

**Washington County  
Noise Control Task Force  
(NCTF)**

**Final Report**

**Volume II**

**Resource Documents**

**Subcommittee report for the  
Committee for Citizen Involvement**

**Representing the  
Citizen Participation Organizations  
of  
Washington County, Oregon**

*“Promoting the protection of community livability  
through effective noise control”*

**July 2005**

**Washington County  
Noise Control Task Force  
(NCTF)**

**Final Report**

**Volume I. Report and Recommendations  
Volume II. Resource Documents**

**July 2005**

**c/o OSU Extension Services  
CAPITAL Center  
18640 NW Walker Road  
Beaverton, OR 97006  
(503) 725-2116**

**Report and Recommendations  
Of the  
Washington County  
Noise Control Task Force  
(NCTF)**

**Volume II  
Resource Documents**

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## Vehicular Traffic Noise

### **Pervasiveness of Traffic Noise Pollution Problem**

Studies have shown that some of the most pervasive sources of noise in our environment today are those associated with transportation. Traffic noise tends to be a dominant noise source in our urban as well as rural environment.

Since transportation is the dominant source of noise in almost all communities; local noise ordinances will be of little benefit unless they apply to transportation noise. The State and Federal Governments have set noise limiting criteria for most modes of transportation. Local ordinances should include equivalent criteria and local authorities should share in its enforcement.

<http://www.fhwa.dot.gov/environment/polguid.pdf>

In recent years, traffic noise - the unpleasant, unwanted sounds generated on our nation's streets and highways - has been of increasing concern both to the public and to local, State, and Federal officials. The study of traffic noise has been extensive. The impacts of vehicle speed, traffic density, vehicle type and equipment condition are well understood. A large part of the information gathered together in this report has been harvested from Federal Highway Administration website, [www.fhwa.dot.gov](http://www.fhwa.dot.gov) and the Noise Pollution Clearing House, [www.nonoise.org](http://www.nonoise.org).

### **Causes of Traffic Noise**

[Source: [www.fhwa.dot.gov](http://www.fhwa.dot.gov)]

The level of highway traffic noise depends on three things: (1) the volume of the traffic, (2) the speed of the traffic, and (3) the number of trucks or other excessively loud vehicles in the traffic stream. Generally, the loudness of traffic noise is increased by heavier traffic volumes, higher speeds, and greater numbers of trucks and other noisy vehicles. Vehicle noise is a combination of the noises produced by the engine, exhaust, and tires. The loudness of traffic noise can also be increased by defective mufflers, other faulty equipment on vehicles, or after market devices installed on vehicles to intentionally increase vehicle noise. In addition, there are other more complicated factors that affect the loudness of traffic noise. For example, as a person moves away from a highway, traffic noise levels are reduced by distance, terrain, vegetation, and natural and manmade obstacles. Traffic noise is not usually a serious problem for people who live more than 500 feet from heavily traveled freeways or more than 100 to 200 feet from lightly traveled roads. Unfortunately large numbers of Washington County residents live along newly designated arterials and collectors often less than 50 feet from increasingly heavily traveled roadways.

### **Characteristics of Traffic Noise Pollution**

For the purpose of highway traffic noise analyses, motor vehicles fall into one of three categories: (1) automobiles - vehicles with two axles and four wheels, (2) medium trucks - vehicles with two axles and six wheels, and (3) heavy trucks - vehicles with three or more axles. The emission levels of all three vehicle types increase as a function of the logarithm of their speed.

In addition, there are other, more complicated factors that affect the loudness of traffic noise. For example, as a person moves away from a highway, traffic noise levels are reduced by distance, terrain, vegetation, and natural and manmade obstacles. Traffic noise is not usually a serious problem for people who live more than 150 meters from heavily traveled freeways or more than 30 to 60 meters from lightly traveled roads.

A reduction of 10 dBA (say 75 dBA to 65 dBA) will be perceived by the public as a halving of the loudness. This is an easily recognizable change. 5 dBA and 7 dBA changes can also be recognized, but to a lesser degree. Two points should be kept in mind: (1) any reduction will improve the noise environment in such areas as annoyance, speech interference, task interference, etc., and (2) no matter what the reduction, until the level reaches a very low level (about  $L_{eq} = 55$  dBA), the noise environment will continue to be dominated by traffic noise that is clearly audible.

**How Traffic Volume Affects Noise**



2000 vehicles per hour sound twice as loud as



200 vehicles per hour

-----**How Speed Affects Traffic Noise**-----



Traffic at 65 miles per hour sounds twice as loud as

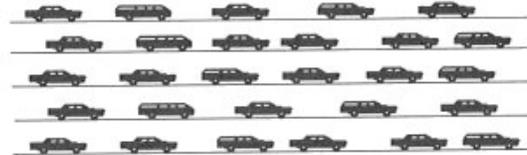


traffic at 30 miles per hour

-----**How Trucks Affect Traffic Noise**-----



One truck at 55 miles per hour sounds as loud as

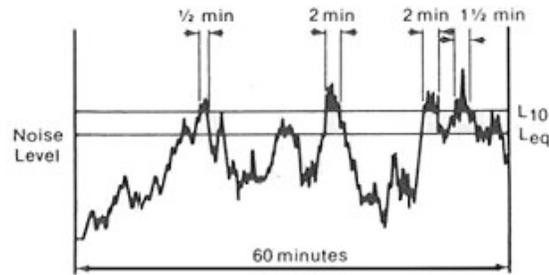


28 cars at 55 miles per hour

**Determining Noise Impact**

Highway traffic noise is never constant. The noise level is always changing with the number, type, and speed, and type of the vehicles which produce the noise as well as the driving habits of the vehicle operator. Traffic noise variations can be plotted on a graph as shown below. However, it is usually inconvenient and cumbersome to represent traffic noise in this manner. A more practical method is to convert the noise data to a single representative number. Statistical descriptors are almost always used as a single number to describe varying traffic noise levels. The two most common statistical descriptors used for traffic noise are L10 and Leq. L10 is the sound level that is exceeded 10 percent of the time.

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In the above graph, the shaded areas represent the amount of time that the L10 value is exceeded. Adding each interval during which this occurred shows that during the 60 minute measuring period the L10 was exceeded 6 minutes ( $1/2 + 2 + 2 + 1 1/2 = 6$ ) or 10 percent of the time. The calculation of Leq is more complex. Leq is the constant, average sound level, which over a period of time contains the same amount of sound energy as the varying levels of the traffic noise. Leq for typical traffic conditions is usually about 3dBA less than the L10 for the same conditions.

The Federal Highway Administration (FHWA) has established noise abatement criteria (NAC) for different land uses close to highways. Some of the exterior criteria are illustrated below.

Land Use	L <sub>eq</sub>	L <sub>10</sub>
Residential	67 dBA	70 dBA
Commercial	72 dBA	75 dBA

If a road project causes a significant increase in the future noise level over the existing noise level, it is also considered to have an impact. The NAC criteria are often used to as a absolute reference as to when a road project causes noise impacts, but noise impacts begin to occur before the federal NAC levels. The states are responsible for determining what constitutes “approaching the NAC”. The State of Oregon regulations sets that level to be 65dBA and 68 dBA.

### Vehicle Types

Roadway vehicles are typically grouped into five acoustically significant types, i.e., vehicles within each type exhibit statistically similar acoustical characteristics. These vehicle types are consistent with the FHWA, TNM, and are defined as follows:

**Automobiles (A):** All vehicles having two axles and four tires and designated primarily for transportation of nine or fewer passengers, i.e., automobiles, or for transportation of cargo, i.e., light trucks. Generally, the gross vehicle weight is less than 4500 kg (9900 lb).

**Medium Trucks (MT):** All cargo vehicles having two axles and six tires. Generally, the gross vehicle weight is greater than 4500 kg (9900 lb) but less than 12,000 kg (26,400 lb).

**Heavy Trucks (HT):** All cargo vehicles having three or more axles. Generally, the gross vehicle weight is greater than 12,000 kg (26,400 lb).

**Buses (B):** All vehicles having two or three axles and designated for transportation of nine or more passengers.

**Motorcycles (MC):** All vehicles having two or three tires with an open-air driver and/or passenger compartment.

## Identified Sources of Vehicular Noise Pollution in Washington County

### Vehicle Speed

Higher vehicle speeds mean more noise (the acoustic effect of increasing vehicle speeds from 55 to 65 mph is the same as doubling the number of vehicles on the road). Figure 2 shows the formulas the State of California uses for estimating vehicle noise emission for various vehicle speeds.

When Congress allowed states to raise speed limits, and many states did raise speed limits from 55 mph to 65 mph and higher, highways in these states got noisier. Similarly, as Washington County continues to raise the posted speed on county streets, the surrounding residences and businesses receive more noise impact. Raising the speed of an automobile 10 mph (from 35 to 45 mph) increases the noise made by that vehicle 3 dB, from 65 dBA to 68 dBA. Similarly, noise made by trucks increases from 80 to 84 dBA with the same 10 mph increase in speed. (In these examples, gas mileage also decreases by 15%.)

The result is a substantial increase in noise for those living and working near highways. Soundwalls are capable of reducing noise levels by 10 dB, so increased speed limits have also significantly reduced the effectiveness of highway noise barriers if present.

Reducing speed limits on roadways and increasing enforcement of speed limits is often the most effective and cost efficient means of reducing noise. For example, reducing vehicle speeds from 40 to 30 mph is as effective as removing one half the vehicles from the roadway.

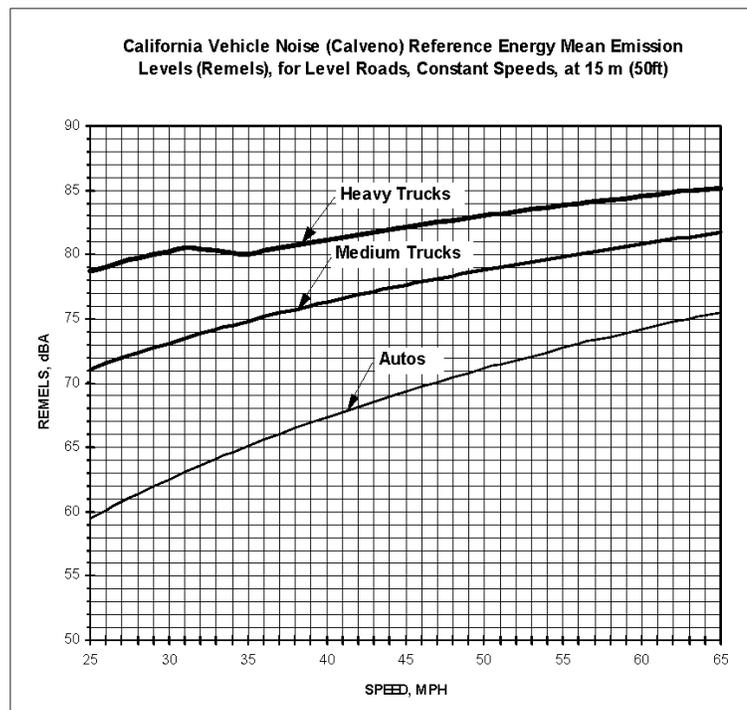
In addition, the number of vehicles on the road is doubling every 10 to 20 years and the American habit of speeding accounts for the equivalent of another doubling of vehicles on the road.

### Improperly Muffled Vehicles

Even though the NAC and time of manufacture standards are exceptionally noisy, enforcing these standards would quiet some of the worst noise polluters in Washington County. Our county has an ordinance requiring mufflers on motor vehicles. Yet the noisiest vehicles often have removed their muffler. The Sheriff's department has not put a priority on preventing vehicles with "straight pipes," usually trucks and motorcycles, from driving around on our roads.

Appendix XX contains estimates of the cumulative noise impact on the hearing health of an individual walking or biking along a road in Washington County where such improperly muffled vehicles routinely operate. It is estimated

California Vehicle Noise Reference Energy Mean Emission Levels



REGRESSION EQUATIONS	
<b>Heavy Trucks:</b>	
25-31 mph (40-50 km/h):	$51.9+19.2\text{Log}_{10}(\text{Speed, mph})$ or $47.9+19.2\text{Log}_{10}(\text{Speed, km/h})$
31-35 mph: (50-56 km/h):	Straight line
<b>Medium Trucks:::</b>	$35.3+25.6\text{Log}_{10}(\text{Speed, mph})$ or $30.0+25.6\text{Log}_{10}(\text{Speed, km/h})$
<b>Autos:</b>	$5.2+38.8\text{Log}_{10}(\text{Speed, mph})$ or $-2.8+38.8\text{Log}_{10}(\text{Speed, km/h})$

Figure 1. Relationship between vehicle speed and noise emissions.

the cumulative impacts from a 1 hour round trip walk on SW Barnes Road without hearing protection would exceed standard workplace OSHA levels significantly.

### Improperly Muffled Trucks

All new vehicles must comply with EPA noise regulations. The maximum permitted noise level for trucks was set to 83 dBA in 1979 and later reduced to 80 dBA in 1988. The overall design and manufacture of heavy-duty trucks, including their exhaust systems, results in all new vehicles meeting the applicable regulations when they leave their manufacturer's factory.

EPA regulations prohibit "The removal or rendering inoperative by any person, other than for purposes of maintenance, repair, or replacement, of any device or element of design incorporated into any new vehicle for the purpose of noise control prior to its sale or delivery to the ultimate purchaser or while it is in use". The EPA regulations also prohibit the use of a vehicle that has had the noise control system rendered inoperative. This is stated clearly on a label required on all vehicles sold in the U.S. and is fully explained in the operator's manual for every new truck.

Most states have adopted motor vehicle regulations that address the configuration and condition of vehicles operated on their roads and highways. These regulations typically require that a vehicle be equipped with a proper exhaust system and a muffler. "Straight stacks" are not in compliance with either the federal or the state regulations.

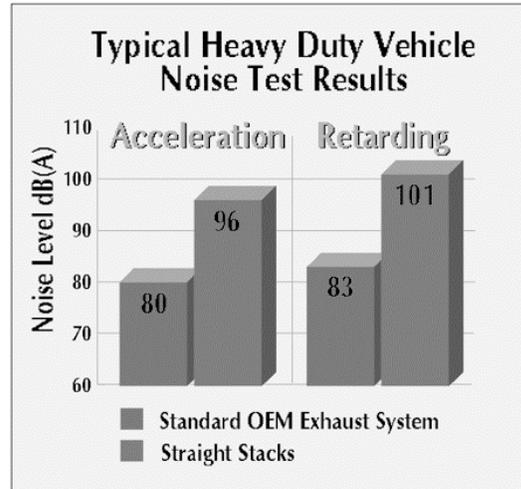
Improperly muffled trucks, in particular trucks using improperly muffled engine brakes, and those using straight stacks, are not operating in compliance with current federal regulations, yet they continue to ply the streets of Washington County. Frequently, it is the same identifiable trucking firm causing the same noise pollution events all over the county area and probable wider region trip upon trip, year after year.

Enforcement of current muffler regulations is the most direct way to address the noise issue. It will have benefits to the trucking industry as well as to the public. Installing the mufflers required by federal and most state motor vehicle regulations on vehicles that are operated without a muffler will reduce noise levels by 16 to 22 dBA(www.jakebrake.com). Actual sound level measurements taken by this committee confirm this statistic. (See Case study.) This does not necessitate anything more than proper maintenance using original equipment mufflers or replacement systems that are equivalent to those provided by the vehicle manufacturer.

The benefits to properly muffling trucks are compelling. Drivers will benefit by being exposed to less on-the-job noise. Vehicle operating safety and productivity will be improved. Controlling the noise level of vehicles by installing proper mufflers will also serve to improve the overall image of the trucking industry.

### Improperly Muffled Motorcycles

There is a growing problem in Washington County as well as the nation with large numbers of improperly muffled motorcycles. Almost half of the motorcycles being used in our county have illegally muffled exhaust systems. The Willamette Week reports nearly half of the 5 million motorcycles on the road have modified exhaust systems that can bring up the volume to 120 or 140 decibels. The committee has actually routinely measured similar 140 dBA levels in



**Figure 1.** Total vehicle sound level data for a typical heavy-duty diesel powered vehicle. The 18 dB(A) increase corresponds to a 8 fold increase in perceived loudness. Source: <http://www.jakebrake.com>.

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a residential area in Washington County. The New York Times Article in Appendix discusses the reasons why and problems these Harley Davidson motorcycle owners are creating not only for non-riding public who is the target of the unmuffled blasting but law-abiding motorcyclists also.

Noise levels above 115 dBA are causes of not only extreme stress in the community but also can cause immediate hearing damage.

## Washington County Factors Contributing to Increased Noise Pollution

### **Growth**

The growth of the county has been strong over the past two decades causing doubling if not tripling in auto, medium and heavy truck usage. The level of law enforcement has not kept up.

### **Sheriff Budgets**

It appears growing portions of Sheriff's budgets are going to combat problems such as drug related law enforcement related to methamphetamine manufacture, sale, and use. These budget shifts directly reduce the ability of the Sheriff to respond to requests to enforce vehicle noise emission noise regulations. The committee has been told in meetings with Sheriff's representatives that even if the Sheriff would chose to enforce the noise emission regulations, there is no money in the budget to cover these costs. The Washington County Board of Commissioners determines the amount of money diverted to the Sheriff Department budget and also evidently sets major priorities on how this money is to spent.

### **Truck Route Plan**

Washington County adopted a Truck Route Plan in the 1990's that designates every minor and major arterial in the county as a 24-hour truck route. Despite protests while the plans were enacted, and over the years since, the county still refuses to address the noise impacts on existing residences along these routes. Trucks up to 80,000lb Gross Vehicle Weight now travel 24 hours a day past homes on residential lines arterials shaking structures and windows with low frequency vibrations and subjecting residents to uncontrolled exhaust noise. Currently, there are no limits to these impacts as there is no law enforcement of existing noise emission standards and dwindling speed limit enforcement.

### **MSTIP**

No money for any type of traffic calming or traffic noise impact reduction has been approved by Washington County for arterial type streets, although neighborhood streets are offered help in these areas. It is not clear why residents living on arterials experiencing noise pollution impacts in excess of federal and state limits do not receive any traffic calming while those living in neighborhoods where the impacts do not exceed any known federal and state standards receive special treatment.

### **Motor Carrier Enforcement**

It is unclear how this program has ever responded to vehicle noise emission regulation enforcement. Its primary purpose seems to be truck weights and possibly some safety inspections. Apparently the function of the group is not to enforce any type of vehicle noise emission regulation, even though it appears they are the identified law enforcement authority to regulate interstate motor vehicles. Evidently, in over a decade of operation, the group never cited even one truck for unmuffled exhaust brake usage--- despite multiple complaints of the same companies repeatedly again using exhaust devices whose noise emissions far exceed state and federal limits. It appears the State of Oregon and Washington County both receive federal funding to conduct interstate motor vehicle law enforcement. This murky area needs closer examination, but it has been difficult to conduct discussion of this area with both county and state officials. It seems the communication lines have been blocked. The Federal Motor Carrier Safety Administration in Washington, D.C. has referred initial questions about the regulations of motor carriers to the state level, but the state has not responded to repeated attempts for clarification and identification of communication contacts.

### **2020 Plan**

Possibly the main reason Washington County has been unresponsive to citizen traffic noise complaints is the 2020 Plan. The main gist of the plan is to deny the delivery of services to unincorporated county residents the services cities typically provide---therefore saving the county money. It would appear at least one of the main goals of the 2020 plan is designed to starve the citizens living in the urbanized county into annexation into a city. The program has been wildly successful. The county has saved much money; they have record budget surpluses according to published reports in the Oregonian Newspaper. A previously agreed upon \$200,000,000 in development impact fees to be paid

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by the local giant, Intel, were rescinded by the county officials due to the large county budget surpluses in 2003. Unfortunately, portions of the Intel tax was to help the county pay for dealing with the impacts of major growth in the county such as traffic-related law enforcement which includes noise emission law enforcement.

### **Conflicting Goals in Transportation Plans**

The stated primary goal of the transportation plan is to move goods and services as quickly as possible in the county. Although the associated negative impacts such as health damaging noise pollution on the livability of affected neighborhoods have been repeatedly pointed out each time the transportation plans have been updated, the county has not taken any steps to deal with the problem nor does it even recognize a problem has been created and currently exists.

### **Washington County Noise Ordinance Update**

For over a decade, it has been certainly clear the County Noise Ordinance has needed updating. According to the previous county counsel, the ordinance needed quantifiable standards in order to be enforceable. Certain members of this noise committee have consistently written, called, and spoke with county officials regarding the need for the Washington County Noise Ordinance to be updated, also. Yet, the county stealthily updated the noise ordinance recently without even contacting such interested individuals when doing so. Evidently the county only wanted to perform updates to areas that staff and administration felt necessary. These types of actions taken by county leaders greatly undermine citizen confidence in the willingness of leadership to respond to legitimate, well-understood, visible citizen concerns.

### **State Speed Control Board**

There is considerable confusion regarding who sets the speed on Washington County roads. Some neighborhoods have repeatedly asked to have posted speeds reduced due to noise pollution and safety reasons. County staff is not aware that speeds on county roads can be adjusted based up other factors than the 85% rule. Please see state speed control appendix. Also note, the 85% rule means 15% of the vehicles are exceeding the speed limit, therefore increasing noise levels and decreasing safety for other drivers, residents, residents with driveways, pedestrians, and bicyclists. Also please note, when a speed limit is raised to the new higher posted level, 15% of the drivers will then exceed the new even higher posted speed limit!

### **Staff Education**

It has been a difficult situation for county staff including Sheriff Deputies throughout the past 20 years of noise pollution investigation. The staff has had to deal with much confusion at the county level regarding 'who does what', 'should we do anything', and 'what the characteristics of noise pollution are'. Over the years the staff responses range from "we can do something and we will" to "it is not feasible to do anything and if you do not like it move somewhere else". Unfortunately, even though there are simple things that can be done to reduce the impacts of traffic noise pollution, apparently the staff has been instructed by administration to not learn about solutions or help citizens with their traffic noise pollution problems. (Probably due to the 2020 Plan.)

There have been some encouraging notes from county staff though. Recently the solid waste management department management took steps to help coordinate county departments with categorized general noise pollution responses. The list of responses provides little support in the area of traffic related areas but it is a great step in the right direction to help reduce staff and citizen frustrations with neighbor-to-neighbor noise and some types of commercial and industrial noise problems.

A commander in the Sheriff's department went to great lengths to learn about the traffic noise problems in the east precinct including state and federal laws, but was later transferred out to the west precinct and is currently serving out of country. His efforts to help on the noise pollution problem in the county were exemplary though and much appreciated.

Recently a "barking dog ordinance" was enacted in Washington County. It includes provisions for a very interesting citizen citation driven process which could serve as a model for traffic related citizen complaint management and enforcement.

### **Vibration Due to Heavy Vehicle Traffic**

Departments of the county including maintenance, operation, and planning need education to learn about the impacts of heavy vehicle traffic causing physical shaking of surrounding properties. When an 80,000lb semi-trailer truck vehicle drops into a rut or runs over an uneven surface of the roadway, it is standard physics that energy will be transmitted in all directions including people's homes if nearby. A small earthquake could be considered similar to the shaking one's house receives if the roadway is not kept smooth and heavy vehicles crash over unevenness in roadways at medium to high speed.

The use of thick Thermoplastic road signage applied directly on the roadway is an example of how one department wants to save money on road repainting costs, but the impacts on surrounding residences and subsequent livability reductions are not part of the consideration. When citizens call in to report such problems, the county staff should be interested in learning more about the problem and not repeating it versus questioning the sanity and sensitivities of the citizen taxpayer.

### **“Unmuffled Exhaust Brake Prohibited” Signage**

The county policy of educating the trucking industry about state laws disallowing routine use of unmuffled exhaust brakes is weak and apparently non-existent. For example, it is impossible to get signage to remind truck drivers not to use unmuffled exhaust brakes in the hilly areas where their use is most prevalent. County staff has made a liability issue argument as to why signs could not be posted on a slope to remind drivers of restrictions. Another argument made is “too many signs already---confuses drivers.” Again, the focus is not on protecting existing neighborhoods, but the goal is to protect the movement of goods and services regardless of the cost to existing neighborhoods.

### **Net Cost of Traffic Law Enforcement**

The committee believes that the cost of creating and administering a traffic noise law enforcement program would not be a budget loser for the county. On the contrary, we believe a program actively identifying and fining noise emission law violators would probably be a net revenue producer. According to the June 1, 2003 Oregonian, New York City spends an average of 22 cents to collect each dollar from parking and traffic violations. Certainly we all hope the cost of county citation processing is just as inexpensive as it is in New York City!

### **Federal Preemption Discussion**

The Sheriff's Department was quite helpful to the Noise committee during its early stages. Unfortunately, communications broke down for some unknown, possibly political reasons, and no further progress was made as the representatives would not return correspondence answering key questions. In particular, it is claimed by Washington County the Sheriff's Department is unable to enforce existing state laws regulating traffic noise pollution. It is argued that the county is 'federally preempted' due to 49 USC §14501 also known as the Federal Aviation Administration Act which is claimed to “deregulate the interstate motor carrier industry.” The committee has reviewed this code and finds nothing in it that relates to noise regulation of motor carriers. The intent of the code was to prevent states from interfering with the “economics” of interstate motor carriers according to a recent Supreme Court case.

The State of Oregon motor vehicle noise emission laws comply with the federal interstate motor carrier noise emission regulations for stationary and in-use operation. The state has not adopted noise regulations that are more stringent than any federal motor vehicle noise emission laws.

### ***What is “federally preempted”***

Adopting noise and other regulations covering trucks (weighing over 10,000lb GVW and registered and engaged in interstate commerce) that do not comply with federal interstate motor vehicle regulations. The state and local interstate motor vehicle inspectors are federally funded and charged with enforcing the existing federal interstate motor vehicle laws including both stationary and in-use, moving noise emission regulations. A truck engaged in interstate motor carrier operation must be registered as such and each qualifying load must either originate, end, or cross state boundaries. A dump truck carrying a load of material from SW Barnes Road in Washington County down to a fill location in Durham Road area is not engaged in interstate commerce.

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### ***What is specifically not “federally preempted”***

The adoption and enforcement of state and local laws covering any vehicle not registered and engaged in interstate commerce, regardless of vehicle weight. Specific devices such as jake brakes can be banned by local ordinance. Local communities can restrict vehicle traffic to certain roadways. Currently, the State of Oregon has modern, enforceable vehicle noise emission regulations that apply in Washington County regardless of the enforceability of the Washington County Noise Ordinance.

### ***Suggestions***

**For interstate vehicles > 10,000lb, Federal Motor Carrier Enforcement.** It would probably be best to set up a standard for when to identify trucks as probable noise emission violators then send them to DEQ for stationary testing.

**For non-interstate vehicles, local authorities.**

Many trucks are not interstate motor carriers anyway due to what they are hauling and who owns what they are hauling. The State of Oregon statutes apply to all of these vehicles.

### **Identification Problem**

It is impossible to identify many commercial vehicles passing by which are probable emission violators. What are the requirements for identification of truck owners/operators?

### **Recommendation for further Washington County Action**

#### ***Noise Ordinance***

Establish a noise ordinance review committee and begin updating the existing antiquated noise ordinance to modern standards.

#### **Law enforcement**

Budget adequate money for Sheriff to properly deal with regulating vehicle noise emissions and traffic speed laws. The program should be self sufficient very soon with citation revenue exceeding expenses.

Consider the establishment of citizen citation process for identified offenders if necessary.

#### ***Known Traffic***

Establish program so known identifiable habitual noise offenders can be cited either by citizens, or law enforcement personnel. This includes easily identifiable commercial trucking companies operating in neighborhoods frequently. Establish mediation program so known offenders can be offered face to face resolution with impacted neighborhood residents.

#### ***Anonymous Traffic***

Sheriff patrols in known at risk areas.

#### ***Speed Limits***

Aggressively enforce posted speed limits in particular in areas where residents are experiencing heavy impacts due to traffic noise pollution. Establish “double fine zones where people’s lives are being impacted by noise pollution.

#### ***Enforcement***

Assume the responsibility and assert the authority granted the county by the DEQ when it handed the vehicle noise programs over to local jurisdictions.

#### ***Equipment***

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Purchase a reasonable amount of sound level metering equipment to get started monitoring and enforcing noise regulations with.

### ***Education***

Educational program should be established and promoted notifying motorists of the laws and the willingness of Washington County to enforce the state and local laws.

### **Suggestions From the Noise Pollution Clearing House to Reduce Traffic Noise**

<http://www.nonoise.org/library/highway/policy.htm>

Following is list of the most easily achievable quick (within a year or two) solutions to reduce the level of traffic noise pollution in the Washington County. Not all solutions may be workable, but the list gives the general direction of where we need to go in Washington County to regain and protect some livability for citizens experiencing excessive traffic noise pollution.

1. Eliminate trucks from the road. In general, trucks are 2-4 times (10-20 decibels louder than cars).
2. Lower the speed limit. Decreasing the speed limit 10mph has the loudness effect of halving the number of vehicles on the road.
3. Enforce existing noise regulations.
  - Oregon State noise emission automobile regulations.
  - State and federal motorcycle rules (40 CFR Part 205)
  - State and federal truck regulations (40 CFR Part 205)
  - Enforce Muffler requirements (motorcycles and Jake brakes)
4. Ban Jake Brakes.
5. Build sound walls, berms, buffers when possible.
6. Help affected residents insulate homes.

## The Cost of Noise – Effects of Road Noise on House Prices

<http://test.bksv.com/bksvsrc/default.asp?ID=2887>

*The Danish Department of the Environment (Milj\_styrelsen) has recently published findings of its research into the effects of road noise on house prices.*

The Danish Government is evaluating different initiatives to reduce road noise, taking the cost and benefits into consideration. To be able to estimate the benefits (health and welfare) associated with reducing road noise, it is necessary not only to quantify these effects, but also to put a price on them.

Part of the nuisance effects from road noise can be evaluated by using the hedonic pricing method that makes use of the fact that the price of a house reflects several parameters (e.g. area, age, number of toilets and the position of the house). By estimating a model including these elements, it is possible to isolate the effect of one single parameter, in this case road noise .

The study shows that houses affected by road noise are significantly cheaper than other houses. The price of houses affected by road noise above 55dB and situated near "ordinary" roads declines by 1.2% per dB. The price of houses near motorways declines by 1.6% per dB. If houses exposed to road noise below 55dB are also included in the model, the average effect on house prices is less – 0.9% for houses near "ordinary" roads and 1.5% for houses near motorways.

Looking in detail at the 8 areas in Greater Copenhagen in the study, it can be seen that the effects on house prices vary from 0.75% to 1.01% for houses near "ordinary" roads and 1.06% to 2.29% for houses near motorways (including houses exposed to road noise below 55dB).

It is not certain whether a potential house owner considers the exact level of noise when he is buying a house, or rather the distance from the noisy road. In one of the models, this parameter is included together with a parameter that describes if a certain house is placed in the first row next to a noisy road or not. A house placed right next to a noisy road is worth 6% less than a house further back. House prices increase by 0.05% if the distance from a noisy road increases by 1%.

### Reference

"Hvad koster St\_j, Milj\_projekt nr. 795", Milj\_styrelsen (2003)

## Harley Davidson Motorcycle After Market and Owner Efforts to Maximize Noise Generation

Located at: <http://www.motorcycle.com/mo/mcbeware/bubs.html>



By [Don Crafts](#), Chicago Desk Editor

You finally did it! You finally mustered up the right mixture of patience, money and insanity to take home a Milwaukee Big Twin, and man is it beautiful. You feel like the king of the world when you're riding, Hog heaven and all that. But wait, there's just one problem: That 600-plus pounds of macho American iron just doesn't sound right. Sure, it has that distinctive (and maybe soon to be trademarked) potato-potato-potato lope and a nice low rumble, but come on, **it's too damn quiet**. And you know those stock staggered dualies are holding back those 80 cubic inches from really hauling you down the road. **What you need is a new set of pipes!**

<http://motorcyclecity.com/Harley-Davidson/V-Rod/1508.htm>

Posted by speed (65.125.169.2) on May 16, 2003 at 17:11:49:

I would like to replace my stock exhaust NOT because I want the classic Harley sound but to save weight. 30 pounds is alot to carry around. Yet, so far all aftermarket pipes I've found have one goal in mind...**max noise**. When I was younger I could handle loud exhaust. Now I just get a headache on a long ride.

<http://www.motorcycle-exhaust.de/exhaust-system/baffle-systems.htm>

From motorcycle-exhaust.com 'Exhaust Systems for Harley Davidson' after market exhaust system website:

"Baffle-System Panhead3 – EEC approved baffle-system with adjustable baffle:

EEC VERSION: The system is closed( as it is delivered), but within 1 second, with the turn of a key, you're able to adjust it to "US" sound !

US Version:

**The system is open and the static noise gets up to 117dBA depending on the engine."**

"Panhead 4 – not adjustable EEC approved system

This system certainly is EEC approved too, but it does not have an adjustable baffle.

Nevertheless, we did not sold in the baffle into the muffler, we screwed it in, so the customer can take it all out !!

This means" after unscrewing it, (not EEC approved), you again will have the sound of a 'porkerpipe' without any baffle !!

**120dBA??? ONLY GOD KNOWS !!**

*The New York Times*

*July 25, 2003*

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**DRIVING; The Biker Question: To Roar or Not to Roar**

By ANN FERRAR

SOMEBODY out there is making Wayne Doenges look bad, and he's not happy about it. Mr. Doenges has been riding motorcycles for 30 years, and with his white hair and reflective two-toned riding jacket, he cuts an impressive figure on the roads of Indiana on his chromed-out six-cylinder Honda Valkyrie. "The bike attracts attention," he said, adding a significant phrase, "in a positive way."

Because he likes that positive reaction, he will not allow his bike to assault you with a mighty avalanche of sound.

Bruce Czerwinski and Michele Moshier see things differently. They are a handsome, ruggedly stylish couple, favoring leather jackets. When Mr. Czerwinski cranks up the 1,500-cc V-twin-cylinder motor of his Suzuki Intruder, the exhaust pipes emit a thunderous roar and a deafening staccato blat-blat-blat. He has replaced the exhaust system that came on his motorcycle with straight pipes -- hollow chrome tubes devoid of any noise-dampening system.

"I do rev the engine at stoplights and I do enjoy showing off," Mr. Czerwinski said. "It's big boys with their big loud toys."

Ms. Moshier said she shared the thrill, reveling in the ear-splitting victory laps the couple take around their hometown of Lowville, N.Y. "Everybody knows it's us," she said.

In the motorcycle world, Mr. Czerwinski, a 42-year-old factory worker, is part of an exuberant and growing cult, contemptuous of noise rules and eagerly supplied with noise enhancement by the aftermarket -- the trade in car and motorcycle parts added by owners.

He is also on one side of a mushrooming conflict among motorcycle owners, pitting the noise lovers against riders like Mr. Doenges, who think the fun isn't worth alienating fellow citizens. (Mr. Doenges, a 75-year-old retired engineer from New Haven, Ind., said his opposition crystallized when he was getting ready to start his bike at a rest stop and saw a small boy cover his ears. He assured the boy not all bikes were loud, he said, annoyed that he had to "make up for what somebody else ruined.")

The two groups don't mingle often, but they both show up at events like the Americade Motorcycle Rally, held last month in Lake George, N.Y., where Mr. Czerwinski and some other bikers on both sides of the issue were interviewed.

More and more American bikers, from the faithful on Harley-Davidson Fatboys to riders on Kawasaki Vulcans and Suzukis like Mr. Czerwinski's, are telling dealers to replace the factory exhaust pipes with aftermarket high-performance exhaust systems, plunking down as much as \$1,000 in the process. The snazzy chrome exhaust pipes have macho names like Samson Big Guns, Screaming Eagles and Cobra High Boy Shotguns. The noise they let out is often in excess of the federal maximum for motorcycles of 80 decibels.

Still, it's not enough for some. Federal regulations say all motorcycle exhaust systems must contain noise dampeners, typically baffles, a series of passages through the muffler that dissipate sound. Straight pipes have no noise dampeners at all, in direct defiance of the law. To demonstrate the effect, Mr. Czerwinski cranked his Intruder's engine. The pipes spat out a Niagara of noise.

Movies like "Biker Boyz" and television programs like "American Chopper," on the Discovery Channel, project an outlaw biker image that celebrates sonic aggression, and many motorcycle magazines not only carry advertisements for

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performance pipes but print covers showing the kind of behavior that goes with them -- riders leaning fast bikes aggressively into curves or doing burnouts: holding the hand brake while revving the engine and spinning the rear wheel until it smokes.

"If people are sitting at an outdoor cafe and 50 motorcycles drive by quietly, no one notices," said Ed Moreland, a lobbyist in Washington for the 270,000-member American Motorcyclist Association, which is officially opposed to excessively loud pipes. "Then one guy rips off a salvo and they snap their heads around. People think all bikes are loud because that's the one they remember."

He sees one result firsthand -- part of his job is fighting outright bans on motorcycles, which he said are being proposed in many parks and gated communities and for some public roads by people fed up with the noise.

All new on-road motorcycles sold in the United States must meet the 80-decibel noise limit. But nearly half of the five million or so registered motorcycles on the road -- a conservative estimate is at least two million -- have modified exhausts, according to a survey by the Motorcycle Industry Council, a motorcycle trade association representing manufacturers and distributors. Many aftermarket pipes are stamped "for closed-course competition only," but it is widely accepted that they end up on street bikes.

"Right now," said Pamela Amette, vice president of the industry council, "it's illegal to install an exhaust system that does not meet federal requirements, but it's not being enforced."

States that inspect motorcycles check for exhaust leaks but not noise. Police with decibel meters would have to test bikes under controlled conditions that aren't feasible on the street. With little to stop riders from knocking out baffles, straight pipes can emit 110 decibels or more, akin to the sound level of a jet climbing at 1,000 feet.

A large part of the motorcycle's allure is the visceral thrill of horsepower, and many riders consider the bike's sound as vital to this sensory experience as the rushing of the wind. The sound of loud pipes is "like opera," according to a Screaming Eagles fan who stated his opinion in a chat room at motorcyclecity.com.

Some loud-pipe owners may enjoy annoying people. Paul Priolo, 30, a chiropractor from Brightwaters, N.Y., rode to Americade on his Harley Fatboy equipped with performance pipes. "I have to be kind and patient all week," he said. "On the bike I let it all hang out. Plus I like being a little obnoxious, riding down the street and setting off car alarms." As for quieter motorcycles, Dr. Priolo said: "I have a friend with a BMW that sounds like a blender. I tell him, 'Hey, I'll have two smoothies with that.' "

Cris Dunham, a 52-year-old bus operator from Queens, is one of many bikers who contend that loud pipes save lives. Ostensibly, the extra noise makes motorcycles more noticeable to drivers in cars and trucks. Ms. Dunham's Kawasaki Vulcan breathes through nonbaffled Vance & Hines Long Shots. With the motor idling, they put forth a deep, loud drumbeat that reaches an earth-shaking crescendo when she revs the engine. "Having been a professional driver for many years, I think it's better for bikes to be seen and heard," she said. She also admits to the influence of peer pressure. "I mainly ride with Harley guys who teased me when I had a smaller bike," she said. "They told me it went tick-tick-tickety."

No lifesaving value in loud pipes has been proved. Most collisions of motorcycles with larger vehicles occur when cars and trucks turn left in front of oncoming bikes, according to a study by the University of California at Los Angeles. Since exhaust noise is emitted behind the motorcycle, these drivers do not hear loud pipes.

Jack Savage, a motorcycle safety instructor and a publisher of motorcycle books, isn't buying the safety angle. "If a guy is such a poor rider that he needs everybody to hear him coming from a mile away," Mr. Savage said, "maybe he should take up knitting."

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RICK GRAY, a 58-year-old lawyer from Lancaster, Pa., owns 13 motorcycles, rides 20,000 to 35,000 miles a year and is chairman of the American Motorcyclist Association. "Too many people tell me, 'I hate motorcycles because they're too loud,'" he said. "This hurts us in other areas, like when we want to lobby for fairer insurance policies."

He fears worse consequences. "If we don't recognize we're a distinct minority in a world growing more environmentally concerned -- and that means noise, too," he said, "we'll become an anachronism."

Personally, Mr. Gray prefers a quieter ride anyway. "To me, riding is like a form of Buddhist meditation," he said. "Just hearing the sound of the wind with nothing intruding on it, not even the engine, is a Zen-like experience." His BMW R1100RT purrs along like a sewing machine. "It's like being in a chair and flying through the air," he said.

Ms. Moshier, who said she loved the attention that a booming motorcycle attracts, may share this attitude to a degree. "At first I hated the straight pipes," she said. **"But it's not as loud when you're on the bike."**

## Criteria for Noise Regulation

1991 Oregon DEQ Document

**Quantitative Limits:** Qualitative or subjective judgments based on people's reaction to noise do not constitute sufficient basis for court judgment of offense. A noise regulation must be quantitative in order to be enforceable. .

**Limiting Criteria:** A regulation should prevent the escalation of noise, therefore it must be limiting. The quantitative criterion should apply equally to all noises of a given class at a given location. The criterion limit of noise at a given location should be determined by the following factors:

1. The character of the location.
2. The time of day.
3. The character of the noise.

**Enforcement:** If enforcement is to be practiced and effective, observation and citation must be possible by many officers in the course of ordinary duties. The basis for enforcement must be a simple meter reading which relates to the effect of noise on people. The A-Band Sound Level is such a reading which can be taken by an officer after a minimum of training.

**Application to Transportation Noise:** Transportation is the dominant source of noise in almost all communities; hence local ordinances will be of little benefit unless they apply to transportation noise. The State and Federal Governments have set noise limiting criteria for most modes of transportation. Local ordinances should include equivalent criteria and local authorities should share in its enforcement.

**Noise Interference With Communication:** Excessive noise interferes with communication by preventing the intelligent reception of voice sounds in ordinary conversation, classroom lectures, over the telephone, and reception of radio and television programs. In some situations, excessive noise can also result in definite safety hazards; e.g., by inability of a truck driver or a factory worker to perceive audible warning signals.

The speech interference effects of noise have been thoroughly studied and are well documented. The criteria which have been developed are expressed in terms of the "Speech Interference Level" (SIL) of the interfering noise and may be expressed in dBA.

The ability to understand speech in the presence of interfering noise depends not only on the magnitude and frequency of the noise but also on the magnitude of the voice of the speaker and the distance between the speaker and listener. The noise levels that permit reliable conversation at various distances when the speech is conducted at normal voice level are shown in Table 2.

**Table 2.**

Noise Levels That Barely Permit Reliable Conversation At Various Distances and a Normal Voice Level	
Distance Between Speaker and Listener	Level of the Interfering Noise
Feet	dBA
1	75
2	70
3	66
4	64
5	62
6	60
10	56
20	50

A typical listener distance for normal conversation in a family residence rarely exceeds ten feet. On this basis, frequently occurring interfering noise in excess of 56.dBA inside residences is unacceptable from a communication standpoint. Also, an interfering noise in excess of 75 dBA is unacceptable in any situation where normal conversation is desired.

**Noise Induced Physiological Stress:** Exposure to noise has been found to cause widespread activation of the autonomic nervous system resulting in heart rate, respiration rate, gastric activity, pupil size, and sweat gland activity. Many studies have been made to assess the significance of these affects and at what noise levels they occur. The stimulus sound levels used in these studies range well above noise levels which interfere with sleep and speech communication. Present data indicate that the threshold of stress response is about 65 dBA and becomes pronounced at 80 to 85 dBA.

**Criteria for Noise Control**

**Criteria Based on the Harmful Effects of Noise:** Criteria for noise control can be based on one or several objectives depending on the goal desired. With respect to the harmful effects of noise on people these objectives can be arrayed .as shown in Table 3.

**Table 3.**

Harmful Effects	Noise Levels at Which Harmful Effects Occur
Prevention of Hearing Loss	75-85 dBA
Prevention of Extra Auditory Physiological Effects	65-75 dBA
Prevention of Speech Interference	50-60 dBA
Prevention of Interruption of Sleep	35-45 dBA

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**Criteria Based on What People Want:** Another approach is to base noise criteria on what most people would like to have in the way of a noise environment; however, this is not so precise. People have lived with increasing *noise* for so long that many have lost any rational basis for judging what they might want if they had an appropriate basis for judgment. A person's reaction to noise is not determined by the noise alone but also by the environment in which the noise occurs. People who live in industrial areas accept more noise than those who live in non-industrial areas and apparently without complaint; however, it is likely they would demand less noise had they a different basis for judgment. This is suggested by the fact that vigorous complaints arise when industrial noise sources are introduced into previously quiet residential areas. The same is true of other noises which are incompatible with the particular environment they may happen to penetrate.

Man is a creature of nature and probably would be most comfortable in a natural noise environment. It would be difficult to test this thesis in our present social-industrial world because any natural perspective has been lost. The question, then, dissolves into what is objectionable with respect to what people want or sensibly should have in the way of a noise environment.

A number of systems have been devised to provide answers to this question. By and large they are based on a noise criterion to which adjustments are made for duration, spectrum, and peaks of noise, the time of day, and the particular environment. The information underlying these systems came from surveys of people's reactions to noise. While it is obvious that such systems result in ranges of noise which are acceptable for different environments and different people, it is equally obvious that most people would prefer the more quiet end of the range for their particular environment. On this basis, *What People Want* is shown in Table 4.

**Table 4.**

<b>What People Want</b>		
<b>Location</b>	<b>Noise Level dBA</b>	
	<b>Day</b>	<b>Night</b>
Rural Residential	35	25
Suburban Residential	40	30
Urban Residential	45	35
Commercial	55	45
Industrial	60	50
Water Recreation Areas (No internal combustion powered watercraft permitted.)	45	35
Water Recreation Areas (Internal combustion powered water craft permitted.)	55	45
Wilderness Areas (No artificial man-made noise.)	30	20

**Criteria Based on What People Will Accept:** People generally will accept a great deal more noise than they really would prefer and without undue complaint. This is evident from a number of studies conducted in cities and in the vicinity of airports. Social surveys conducted in Central London, near London Airports, and several American cities are illuminating. Of thousands of people interviewed, about one-fourth of those present in any stratum of noise intensity seemed to be unperturbed. They apparently live happily next to elevated train routes, truck routes, airports, or other noisy activities. About one-tenth of those interviewed seemed to be disturbed by almost any audible noise not of their own making, regardless of the level. Of those in areas with a specific loud noise, about one-third said that they tended to get used to the noise and about one-fourth said the noise became more bothersome with time.

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Because of this variation in the way people react to noise, it is not possible to determine fixed noise limits acceptable to all people under all circumstances. However, sufficient information is at hand to suggest limits within ranges which are acceptable to most people and for most environments. This information is derived from the same studies and systems used to determine what people want. The ranges of noise most people will accept without undue complaint are shown in Table 5.

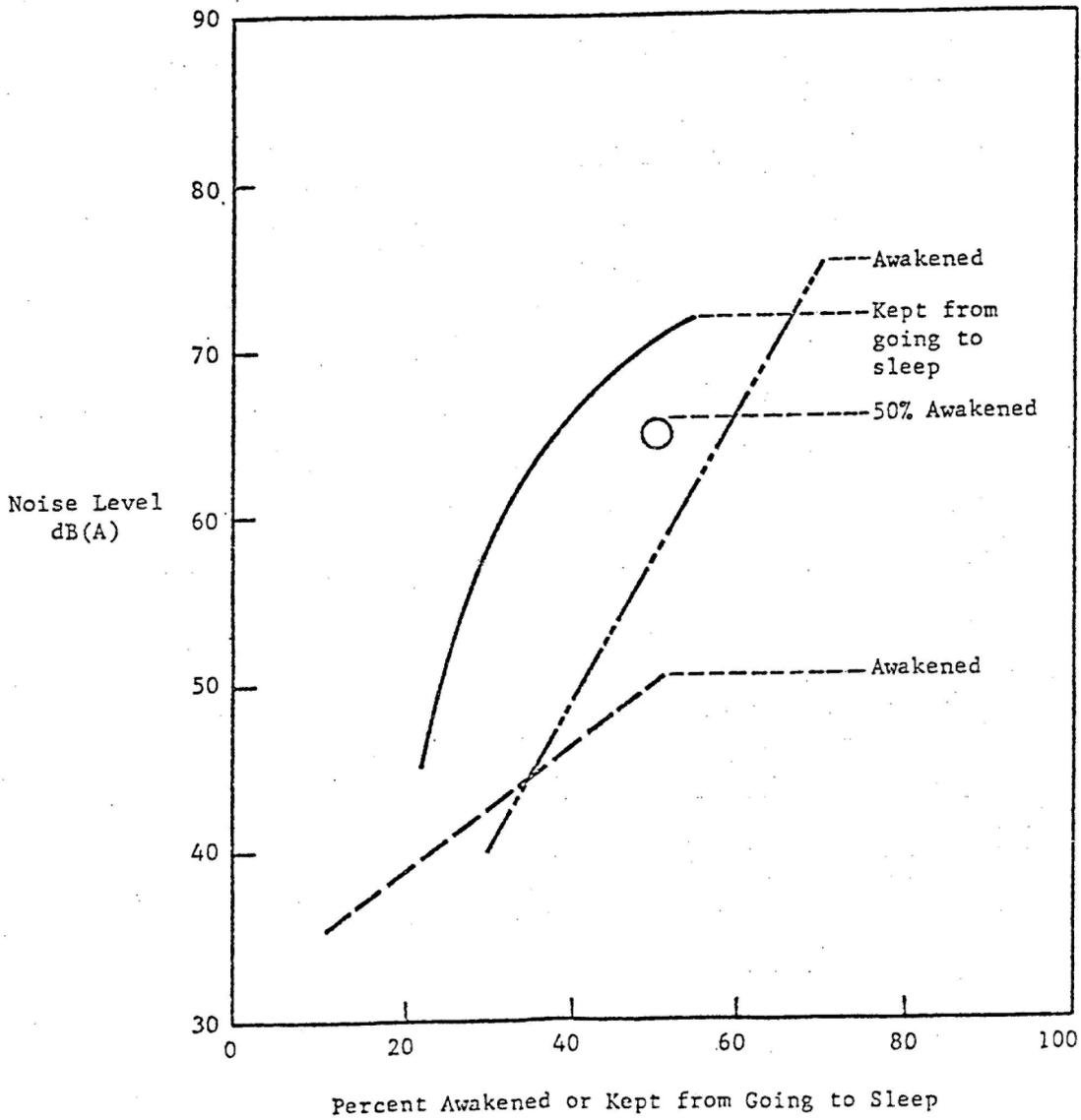
**Table 5.**

<b>What People Will Accept Without Undue Complaint</b>		
<b>Location</b>	<b>Noise Level dBA</b>	
	<b>Day</b>	<b>Night</b>
Rural Residential	35-45	25-35
Suburban Residential	40-50	30-40
Urban Residential	45-55	35-45
Commercial	55-65	45-55
Industrial	60-70	50-60

**Community Responses to Noise:** Numerous studies have been made to test community responses to noise. These studies show that people begin to complain when noise levels exceed the ranges shown in Table 5 and the vigorousness of complaint increases as the level of noise increases. The intensity of complaints for incremental increases in noise above acceptable levels are shown in Table 6.

**Table 6.**

<b>Estimated Community Response to Noise</b>	
<b>Noise Level in dBA Above the Acceptable Level</b>	<b>Estimated Community Response</b>
0	No Observed reaction
5	Sporadic Complaints
10	Widespread Complaints
15	Threats of Action
20	Vigorous Action



SLEEP DISTURBANCE BY NOISE

Figure 1

## SOUND LEVEL MEASUREMENTS FOR LIVABILITY vs. SAFETY

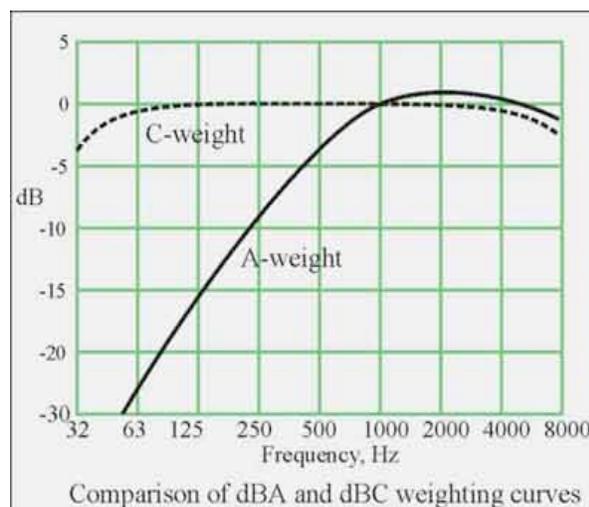
Noise sources tend to produce sounds over a wide range of frequencies and can be quite complex. The human ear has sensitivity to many frequencies and sound levels with effects including relaxation, pleasure, distraction, irritation, and health impairment.

### SAFETY

All industrial sound pressure level measurements and specifications have traditionally been based on dBA weighting. This addresses half of the noise pollution issue, namely safety. dBA is primarily applicable to OSHA and similar concerns over actual hearing loss since it is heavily weighted toward the damaging high frequencies (above 1 kHz). Hearing damage may occur with repeated exposure to sound pressure levels above 85 dBA. Sound pressure levels below that are presumed safe from the hearing standpoint but can still be very irritating and may lead to temporary physical and mental health disorders. Fortunately, high frequencies are the easiest to control with barriers, distance, sound absorbers such as carpets, draperies and acoustical tiles, or in extreme cases with muff type hearing protectors. Merely being indoors (for externally generated high frequency noise) greatly reduces these frequencies to safe but still potentially annoying levels.

### LIVEABILITY

Of equal or possibly even greater noise pollution concern is the *nuisance factor* which in an increasingly urban environment is becoming a more frequent complaint. Low frequency noise is generated by such things as modified (amplified) automobile exhaust systems, unmuffled exhaust brakes, heavy trucks and busses, "boom boxes", and high powered car stereos. These low frequency sounds may be characterized as thumps, rumbles, or booming. These low frequencies are NOT absorbed to any appreciable degree by common building materials and foliage and may be audible at distances of \_ mile or more. For measurement of these frequencies, the dBC weighting as defined by IEC 60651 is required to properly measure the sound pressure level. dBC weighting gives nearly equal emphasis to all normal hearing frequencies without reducing sensitivity to the potentially damaging high frequencies. Readings taken with dBA weighting minimize the effect of low frequencies. For example, referring to the following chart, readings at 100 Hz readings in dBA will be 20 dB lower than if measured in dBC.



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### PEAK vs. AVERAGE READINGS

Peak readings are more indicative of livability than average readings. Take for example a single passage of a single vehicle with an unmuffled or amplified exhaust system through a residential neighborhood at 3 AM. Sleep of a number of people may be disturbed. An average dB reading for the hour will be quite low and indicate no noise problem while the high peak reading will more correctly indicate the impact on residents.

Average readings are of more value for determining potential hearing loss since since hearing damage is cumulative. Areas having continuous heavy traffic such as near freeways would be an example of where average measurements are used although even there occasional excessively loud vehicles are still more disturbing to nearby residents.

Peter A. Keller  
31 March 2005

## More Detailed Sound & Noise Primer

Sound is created when an object moves; the rustling of leaves as the wind blows, the air passing through our vocal chords, the almost invisible movement of the speakers on a stereo. The movements cause vibrations of the molecules in air to move in waves like ripples on water when the vibrations reach our ears, we hear what we call sound. Noise is defined as *unwanted* sound.

Sound is produced by the vibration of sound pressure waves in the air. The rate of vibration of the sound pressures waves is referred to as the *frequency* of the sound. Pitch is another term used to describe the frequency of a sound source if the sound wave contains primarily a single frequency and has a tonal quality. Other types of sound are more complex in frequency nature and are composed of hundreds of individual sound frequencies. Sound pressure levels are used to measure the intensity of sound and are described in terms of decibels. The decibel (dB) is a logarithmic unit which expresses the ratio of the sound pressure level being measured to a standard reference level.

Sound is composed of various frequencies, but the human ear does not respond to all frequencies. Frequencies to which the human ear does not respond must be filtered out when measuring environmental sound and noise levels. Sound-level meters are equipped with weighting circuits which filter out selected frequencies. It has been found that the A-scale on a sound-level meter best approximates the frequency response of the human ear. Sound pressure levels measured on the A-scale of a sound meter are abbreviated dBA. Another commonly used scale, the C-weighting scale, is often used when measuring noise emissions that contain low frequency components. While the ear might not hear them as well, the low frequency components typically contain more sound energy and have the ability to physically shake homes, windows, and other structures. For example, the C-weighting scale, commonly abbreviated dBC, is often used when measuring the sound emissions of rock blasting operations. The *linear*, or L-weighted, scale, also referred to as the *un-weighted* scale, is available on some sound-level meters. As the name implies, the linear scale weights all frequency components equally across the measurement range. The linear scale is sometimes used when performing human noise exposure measurements.

In addition to noise varying in frequency, noise intensity fluctuates with time. In the past few years, there has been a definite trend toward the use of the equivalent (energy-average) sound level as the descriptor of environmental noise in the U.S. The equivalent sound level is the steady-state, A-weighted sound level which contains the same amount of acoustic energy as the actual time-varying, A-weighted sound level over a specified period of time. If the time period is 1 hour, the descriptor is the hourly equivalent sound level,  $L_{eq}(h)$ , which is widely used as a descriptor of noise. An additional descriptor, which is sometimes used, is the  $L_{10}$ . This is simply the A-weighted sound level that is exceeded 10 percent of the time.

A few general relationships may help in understanding sound generation and propagation. First, as already mentioned above, decibels are logarithmic units. Consequently, sound levels cannot be added by ordinary arithmetic means. A chart for decibel addition is shown in Table 1. From this table it can be seen that the sound pressure level from two equal sources is 3 dB greater than the sound pressure level of just one source. Therefore, two trucks producing 90 dB each will combine to produce 93 dB, not 180 dB. In other words, a doubling of the noise source produces only a 3 dB increase in the sound pressure level. Studies have shown that this increase is barely detectable by the human ear.

For noise levels known or desired to an accuracy of +/- 1 decibel (acceptable for most noise analyses):

**Table 1. Rules for Combining Sound Levels by "Decibel Addition".**

<u>When two decibel values differ by</u>	<u>Add the following amount to the higher value</u>
0 or 1 dB	3 dB
2 or 3 dB	2 dB

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4 or 9 dB	1 dB
10 dB or more	0 dB

Secondly, an increase or decrease of 10 dB in the sound pressure level will be perceived by an observer to be a doubling or halving of the sound. For example, a sound at 60 dB will sound half as loud as a sound at 70 dB as shown in Table 2.

**Table 2. Decibel Changes, Loudness, and Energy Loss.**

<u>Sound Level Change</u>	<u>Relative Loudness</u>	<u>Acoustic Energy Loss</u>
0 dBA	Reference	0
-3 dBA	Barely Perceptible Change	50%
-5 dBA	Readily Perceptible Change	67%
-10 dBA	Half as Loud	90%
-20 dBA	1/4 as Loud	99%
-30 dBA	1/8 as Loud	99.9%

Finally, sound intensity decreases in proportion with the square of the distance from the source. Generally, sound levels for a *point source* such as a single vehicle or machine will decrease by 6 dBA for each doubling of distance. Sound levels for a highway *line source* vary differently with distance, because sound pressure waves are propagated all along the line and overlap at the point of measurement. A long, closely spaced continuous line of vehicles along a roadway becomes a line source and produces a 3 dBA decrease in sound level for each doubling of distance. However, experimental evidence has shown that where sound from a highway propagates close to "soft" ground (e.g., plowed farmland, grass, crops, etc.), the most suitable dropoff rate to use is not 3 dBA but rather 4.5 dBA per distance doubling. This 4.5 dBA dropoff rate is usually used in traffic noise analyses for line source prediction and measurement.

### ***Significance of Time-Weighted Averages (Leq)***

<http://www.ttsfo.com/sbcteis/deis/Appendices/Appendix%20H1.pdf>

The calculation procedure used for computing average noise levels (Leq values) results in high dB events contributing significantly more to the final Leq value than do background low dB conditions. For example, a single 1-second episode of 90 dBA introduced into a 1-hour constant background noise condition of 45 dBA will result in a 1-hour Leq value of 54.9 dBA. A 5-second episode of 90 dBA in a 1-hour background condition of 45 dBA results in a 1-hour Leq of 61.5 dBA. And a cumulative total of 20 seconds of 90 dBA in a 1-hour background condition of 45 dBA results in a 1-hour Leq of 67.5 dBA.

Even in the context of 24-hour averages, brief noise events have a noticeable effect. A 5-second episode of 90 dBA in a 24-hour background condition of 45 dBA raises the 24-hour Leq to 49.5 dBA. A cumulative total of 20 seconds of 90 dBA in a 24-hour background condition of 45 dBA results in a 24-hour Leq of 54.2 dBA.

### **Types of Noise**

Adapted from Bruel&Kjaer Environment Noise Handbook, 2001

#### **Noise is not Just Noise**

At home and at work, we often hear noise from ventilation or heating systems that is hardly noticeable because it has no prominent features. The noise never stops and has no tone, but if the fan suddenly stops or starts to whine, the change may disturb or even annoy us. Our hearing recognizes information in the sounds that we hear. Information we don't need or want is noise. Noise features that make us listen and take notice are tones or changes in sound level. The more prominent the tone, and the more abrupt the change in sound level, the more noticeable the noise.

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### Continuous Noise

Continuous noise is produced by machinery that operates without interruption in the same mode, for example, blowers, pumps and processing equipment. Measuring for just a few minutes with hand-held equipment is sufficient to determine the noise level. If tones or low frequencies are heard, sound-level meters that also frequency spectrum can be used for further documentation and analysis.

### Intermittent Noise

When machinery operates in cycles, or when single vehicles pass by, the noise level increases and decreases rapidly. For each cycle of a machinery noise source, the noise level can be measured just as for continuous noise. However, the cycle duration must be noted. A single passing vehicle is called an event. To measure the noise of an event, the Sound Exposure Level, (SEL) is measured, combining level and duration into a single descriptor. The maximum sound pressure level may also be used to measure single vehicle pass-by noise emissions. This is the method primarily used in the U.S. to measure in-use vehicle noise emissions.

### Impulsive Noise

The noise from impacts or explosions, e.g., from a pile driver, punch press or gunshot, is called impulsive noise. It is brief and abrupt, and its startling effect causes greater annoyance than would be expected from a simple measurement of sound pressure level.

Impulse noises of substantial magnitude (e.g., blasting or sonic booms) often are characterized using unweighted (flat or linear) or C-weighted SEL measures. Annoyance from such sources often involves induced structural vibrations as well as the loudness of the noise event. Unweighted and C-weighted decibel scales have proven more useful than the A-weighted scale for such evaluations. Less intense impulse noises often are characterized using an A-weighted SEL measure.

Oregon law defines "impulse sound" as a sound with either a single pressure peak or single burst (multiple pressure peaks) for a duration of less than one second as measured using unweighted peak dB or measuring dBC using a slow reading sound-level meter.<sup>1</sup>

### Tones in Noise

Annoying tones are created in two ways: Machinery with rotating parts such as motors, gearboxes, fans and pumps often create tones. Unbalance or repeated impacts cause vibration that, transmitted through surfaces into the air, can be heard as tones. Pulsating flows of liquids or gases can also create tones, caused by combustion processes or flow restrictions. Tones can be identified subjectively by listening, or objectively using frequency analysis. The audibility is then calculated by comparing the tone level to the level of the surrounding spectral components.

### Low Frequency Noise

Low frequency noise has significant acoustic energy in the frequency range 8 to 100Hz. Noise of this kind is typical for large diesel engines in trains, ships, and power plants and, since the noise is hard to muffle and spreads easily in all directions, it can be heard for miles. Since the low frequency noise is more annoying than would be expected from the A-weighted sound pressure level measurements, the C-weighted scale is often used when documenting these sound emissions.

## Sound and Noise and Relationships

The A-weighted decibel scale begins at zero. This represents the faintest sound that can be heard by humans with very good hearing. Table 3 illustrates the range of sound pressure levels in dBA found in our modern day environment, although sonic booms are not as common today as they were a few decades ago. Sound pressure levels at or above 115 can cause immediate hearing damage. The 140dBA sound pressure level is from an unmuffled motorcycle with

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<sup>1</sup> "Slow" refers to a sound-level meter *time-weighting* setting. Usually a sound-level meter provide *Fast* and *Slow* settings to change the meter reading response time. When using the fast setting, the measurement rises and falls quickly to better track the sound source noise intensity change over time. The slow setting is often used when measuring impulse noise because it has tendency to capture the peak noise level or the brief event and hold it on the display longer thus enabling the operator to better observe and document the event.

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“straight pipe” exhaust.<sup>2</sup> The Relative Loudness column of the table indicates how perceived loudness is doubled with every 10 dBA increase in sound pressure level while the Relative Sound Energy Level increases logarithmically.

To the non-mathematician type, Figure 1 might be more illustrative of the how sound adds up logarithmically. If ordinary conversation at 2 feet, 60dBA, is used a reference, hopefully it is readily apparent from the graphical bars how much louder 140dBA is heard than ordinary conversation. Each 10dBA increase in sound pressure level doubles the entire previous amount. So if 120dBA is so loud that buildings can be damaged by the emission, 140 dBA is even twice louder!

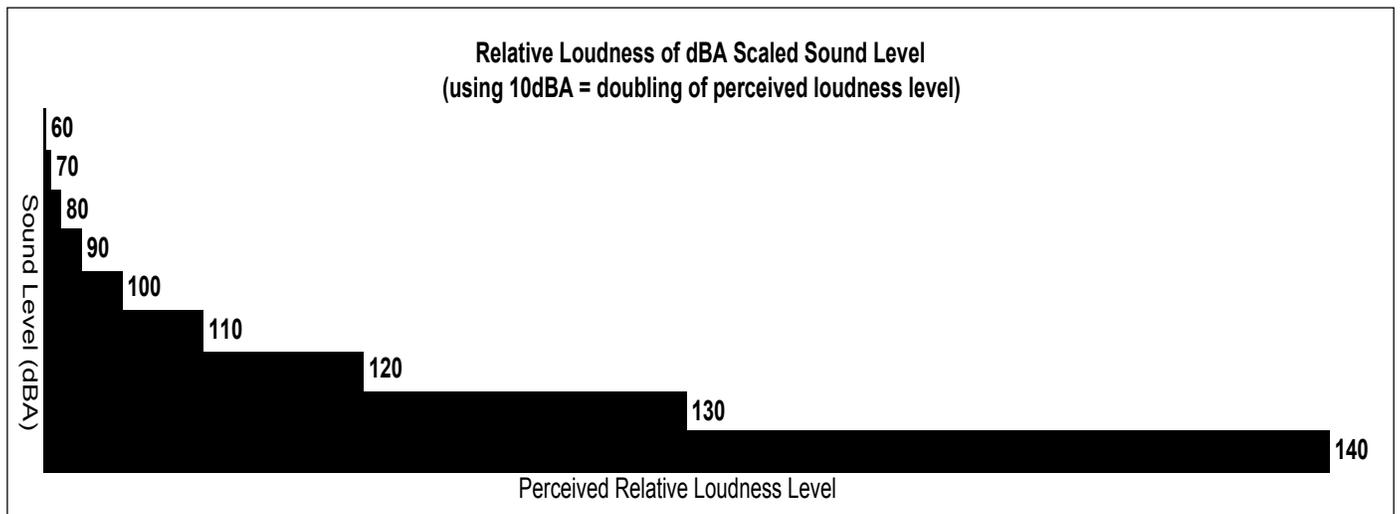
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<sup>2</sup> Modified, unmuffled motorcycles emitting such high dBA noise levels are common throughout the Portland Metro area. A sound pressure level of such high level can cause immediate and non-repairable human hearing damage, in particular, it is thought, in infants and young children. One of the goals of this noise committee work is to educate the county officials and the public on the dangers pedestrians, bicyclists, landscape workers, and motorcyclists themselves are facing due to growing numbers of such loud vehicles traveling everywhere in the county.

**Table 1. Relative loudness of noise conditions, dB scaled, logarithmic view.**

<b>Examples of A-Weighted Sound Levels and Relative Loudness</b>				
<b>Characterization</b>	<b>Example Noise Condition or Event</b>	<b>Sound Level dBA</b>	<b>Relative Loudness (Approx.)</b>	<b>Relative Sound Energy Level</b>
	Unmuffled Harley Davidson @ 2 feet, Curbside	140	256	100,000,000
Threshold of pain	Surface Detonation, 30lbs of TNT @ 1000 feet	130	128	10,000,000
Possible building damage	Mach 1.1 sonic boom under aircraft @12,000 feet	120	64	1,000,000
Threshold for immediate hearing damage (115)	Peak crowd noise, pro football game, open stadium	110	32	100,000
	Jet flyover @ 1000 feet	100	16	10,000
Extremely Noisy (95)	Leaf blower @ 5 feet	90	8	1,000
	2 axle commercial truck@20feet, 35mph	80	4	100
Noisy (75)	Vacuum cleaner @ 10 feet	70	2	10
	Ordinary conversation @ 3 feet	60	1	1
Quiet (45)	Suburban area background conditions, day	50	1/2	0.1
	Quite Suburban area, night	40	1/4	0.01
Very Quiet	Quite rural area, night, no wind	30	1/8	0.001
	Quite Country Residence	20	1/16	0.0001
Barely Audible	Rustling Leaves	10	1/32	0.00001
Threshold of Hearing		0	1/64	0.000001

**Figure 1. Relative loudness of noise conditions, linearly scaled, perceived loudness view.**



## Example of Sound Level Meter Suitable for Noise Law Enforcement

The Bruel & Kjaer, [www.bksv.com](http://www.bksv.com), Precision Sound Level Meter Type 2232 pictured here is an inexpensive instrument for making community noise surveys. The cost is around \$1000. It is designed for ease of operation so even the inexperienced user can carry out reliable measurements quickly and effectively.



The Type 2232 is designed to be a tool for environmental health inspectors and other personnel concerned with maintaining acceptable noise levels in industrial and residential locations, for instance police officers checking domestic noise disturbance calls. Another well known manufacturer of similar high end type sound level meters and acoustical instrumentation is Larson Davis, [www.larsondavis.com](http://www.larsondavis.com).

There are many low cost sound meters on the market that are often completely acceptable for documenting community noise events. Radio Shack, [www.radioshack.com](http://www.radioshack.com), retails at less than \$50, both analog and digital portable, pocket sized sound-level meter devices. Recently noise data acquisition software products have become available that are capable of turning an ordinary personal computer and any sound level meter with a conditioned AC analog signal output (Radio Shack model 33-2050, cost \$30) into an extremely low cost noise data acquisition system. An example of such a system, the Jade 2 is found at [www.ptolserv.com](http://www.ptolserv.com). This system supports complete measurement control, noise event recording, and statistical analysis, charting, and reporting capabilities.

## Noise Exposure and Hearing Health

[Adapted from: <http://www.ttsfo.com/sbcteis/deis/Appendices/Appendix%20H1.pdf>]

Exposure to loud sounds can cause both temporary and permanent hearing threshold shifts. A temporary hearing threshold shift occurs if normal hearing sensitivity returns after a period without exposure to high noise levels. The period required for recovery from temporary threshold shift effects can range from minutes to several hours, depending on the intensity and duration of the noise exposure that produced the threshold shift. Even when recovery from temporary threshold shifts routinely occurs, permanent loss of hearing sensitivity still can occur as a result of long term cumulative noise exposure. Permanent loss of hearing sensitivity (a permanent increase in the hearing threshold at one or more frequency bands) occurs in two ways:

- 1) as a progressive, long term result of cumulative noise exposure; and
- 2) as an immediate result of exposure to high noise levels, regardless of exposure duration.

The U.S. Environmental Protection Agency (EPA) identified an annual average 24-hour Leq of 70dBA as a long term noise exposure limit that should protect the general public against hearing damage with an adequate margin of safety (EPA 1974, 28-32). Noise levels obviously vary during the course of a day, but a 24-hour Leq of 70 dBA implies that there would not be any extended periods of exposure to high noise levels. To put a 24-hour Leq of 70 dBA in perspective, each of the following noise exposure conditions would generate a 24-hour Leq of 70 dBA or more:

- an 8-hour work day with an average noise exposure of 74.8 dBA (for example: 21 minutes at 85 dBA, 30 minutes at 80 dBA, 30 minutes at 75 dBA, and 6 hours 39 minutes at 70 dBA);
- 2 hours 25 minutes at 80 dBA and 21 hours 35 minutes at any noise level below 70 dBA;
- 46 minutes at 85 dBA and 23 hours 14 minutes at any noise level below 70 dBA;
- 15 minutes at 90 dBA and 23 hours 45 minutes at any noise level below 70 dBA;
- 5 minutes at 95 dBA and 23 hours 55 minutes at any noise level below 70 dBA; or
- 1.5 minutes at 100 dBA and 23 hours 58.5 minutes at any noise level below 70 dBA.

The National Institute for Occupational Safety and Health (NIOSH) has determined that above a critical sound intensity, the mechanism of hearing damage changes from one based on cumulative noise exposure (the combination of magnitude and duration of sound) to a mechanism based on sound intensity alone, regardless of duration (NIOSH 1996). NIOSH estimates 115 to 120 dBA as the critical noise level at which human hearing is subject

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to instantaneous permanent damage effects. Without adequate hearing protection, any exposure to noise levels above 115 dBA is likely to cause some degree of permanent hearing threshold shift.

An impulse noise is a sound with a very sharp attack or fast rise in volume. For sounds of intensity of 75-90 dBA, the ear has a protective mechanism to reduce its sensitivity to low frequency impact sounds by changing the mode of oscillation of the bone structure of the middle. However, it takes approximately 0.5 seconds before this protection mechanism is fully operational. Most naturally occurring sounds have longer volume rise times, thus the ear can easily cope with them. Unfortunately, in our time, man has created many man-made sounds such as explosions from guns and artillery and countless types of industrial and vehicles noises. These man-made sounds can have such sharp attacks or rise times the ear cannot respond quickly enough to protect itself. The resulting hearing loss is permanent and results from the deterioration of hair cells in the Organ of Corti region of the ear due to even brief exposure to some intense noises.

### Noise Exposure and Physiologic Health

[Adapted from: <http://www.tsfo.com/sbcteis/deis/Appendices/Appendix%20H1.pdf>]

***Stress-Related Physiological Effects.*** Noise is a recognized contributor to generalized stress conditions, but it is difficult to distinguish the contribution of noise exposure versus other factors to overall stress conditions at any given time. General physiological indicators of stress, such as changes in cardiovascular and endocrine conditions, undoubtedly accompany any stress reactions related to noise exposure. Loud noises in general tend to produce dilation of the pupil of the eye, increased heart rate, and vasoconstriction of the extremities (Ward 1998, 1197).

***Psychological and Behavioral Effects.*** General annoyance is the most common reaction to noise, although stress-related behavioral changes or reactions also occur. Annoyance related to noise conditions depends on many factors in addition to the magnitude, duration, variability, and time of day of noise events. Personal attitudes and opinions concerning recognizable noise sources can be an important influence. A person's previous exposure to various noise conditions also is important in shaping personal reaction to ongoing or new noise conditions. Nevertheless, numerous studies and surveys have been performed to characterize the extent of annoyance associated with various noise sources and noise levels. Most of these studies and surveys have evaluated annoyance to noise from transportation sources (highway traffic, rail traffic, and aircraft flight operations) because those are the dominant noise sources affecting urban areas. Several different equations have been developed to estimate the fraction of the population that will rate itself as "highly annoyed" under different average noise level exposure conditions as described in the Volume II: Criteria for Noise Regulations document. Other equations have been developed to relate average noise exposure conditions for high energy impulse noise events to the fraction of the population that will be highly annoyed. Most of these equations use the 24-hour Ldn<sup>3</sup> noise value as the predictor of annoyance. Startle reactions to sudden, unexpected loud noises produce an immediate contraction of the orbital eye muscles and the flexor muscles of the legs, arms, and back; this results in an automatic eye blink and crouching movement (Ward 1998, 1199). If loud impulse noise events are repetitive and relatively predictable, the intensity of the startle reaction tends to be significantly reduced. Startle reactions can pose a safety hazard under some conditions. Insomnia (chronic difficulty in falling asleep or chronic difficulty staying asleep) is a symptom of other medical or psychological conditions. The extent to which noise conditions actually produce insomnia (as opposed to occasional awakening from sleep) is not clear.

***Activity Interference Effects.*** Annoyance and noise-related stress conditions can result in a wide range activity interference including speech and communication interference, interference with cultural activities, reduced work productivity, and disruption of leisure activities. If such activity interference is a long-term condition, then noise conditions can lead to land use compatibility problems. Noise-related land use compatibility problems have led various federal, state, and local agencies to develop a wide range of noise related land-use planning guidelines and regulations but there are currently no known planning guidelines to deal with the affects of noise on existing land-owners and land-use development patterns this studies authors are aware of. The only protection existing land-owners have is the existing noise regulations and ordinances and the effective enforcement thereof.

***Physical Effects on Buildings and Structures.*** Physical effects of noise on buildings and other structures occur primarily through airborne or ground vibrations. Most ground vibrations are generated by underground sources or by sources in physical contact with the ground surface. Open air noise sources rarely generate detectable ground

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<sup>3</sup> Ldn refers to Day-night level. It is a descriptor of noise level based on energy equivalent noise level (Leq) over the whole day with a penalty of 10 dBA for night time noise (22:00-7:00 hrs).

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vibrations. Although many people attribute building vibration and object shaking to ground vibrations, most such events are caused by vibrations induced by airborne sound. Direct ground vibration is important only at locations close to the vibration source. Sonic booms and blast noise events are the major sources of airborne vibrations that can be strong enough to create detectable vibrations in buildings or structures. It is subjectively thought by many committee members, road surface unevenness (pot holes, cracks, thick painting) cause heavy vehicles to transmit ground vibrations into nearby structures, but this particular traffic related vibration source has not been completely documented at the time of this report. Vibration intensities can be measured in many different ways, but movement velocity units (such as inches per second) are commonly used. Common vibration criteria and guidelines can be summarized as follows (U.S. Army Center for Health Promotion and Preventive Medicine 1999). Most people can detect structural vibrations at an intensity of 0.08 inches per second. Vibrations become noticeable at an intensity of 0.20 inches per second. Many people rate a vibration intensity of 0.38 inches per second as unpleasant, and an intensity of 0.8 inches per second as disturbing. A vibration intensity of 0.1 inches per second can cause loose objects to rattle. A vibration intensity of 0.5 inches per second often is used as a guideline for avoiding minor cracking in poorly fitted loose glass windows or in stressed plaster. A vibration intensity limit of 2 inches per second often is used as a guideline for avoiding damage to lightweight structures. Cracking of concrete may occur at vibration intensities above 4 inches per second. Minor structural damage is likely at a vibration intensity of 5.4 inches per second. A peak unweighted noise level of 120 dB is likely to induce a structural vibration intensity of about 0.1 inches per second, which is detectable and can cause loose objects to rattle. A peak unweighted noise level of 134 dB can produce a vibration intensity of 0.5 inches per second. A peak 16 unweighted noise level of 175 dB can produce a vibration intensity of 2 inches per second, which is near the threshold for damage to lightweight structures. The peak unweighted noise level must exceed 185 dB to produce vibration intensities of 4 inches per second or more.

### Regulatory Context

#### *Federal Legislation*

The Noise Pollution and Abatement Act of 1970 (Title IV of the Clean Air Act, 42 USC 7627) established an Office of Noise Abatement and Control within EPA. The EPA was directed to investigate and identify the effects of noise levels on public health and welfare, including: psychological and physiological effects on humans; effects of sporadic extreme noise as compared with constant noise; effects on wildlife and property; effects of sonic booms on 19 property; and such other matters as may be of interest in the public welfare. Title IV of the Clean Air Act also requires other federal agencies and departments to consult with EPA regarding methods for abating objectionable or nuisance condition noise impacts that result from activities they carry out or sponsor.

The federal Noise Control Act of 1972 (42 USC 4901 *et seq.*) established a requirement that all federal agencies must administer their programs in a manner that promotes an environment free from noise that jeopardized public health or welfare. EPA was given the responsibility for: providing information to the public regarding identifiable effects of noise on public health or welfare, publishing information on the levels of environmental noise that will protect the public health and welfare with an adequate margin of safety, coordinating federal research and activities related to noise control, and establishing federal noise emission standards for selected products distributed in interstate commerce (construction equipment; transportation equipment; motors and engines; and electrical or electronic equipment). Aircraft, aircraft engines, military weapons, military combat equipment, rockets and other equipment used by the National Aeronautics and Space Administration, and various other items were excluded from the definition of products distributed in commerce. States and political subdivisions thereof retain the right to establish and enforce controls on environmental noise through the licensing, regulation, or restriction of the use, operation, or movement of products or combinations of products. The federal Noise Control Act also directed all federal agencies to comply with federal, state, interstate, and local noise control and abatement requirements to the same extent that any person is subject to such requirements.

Although the EPA can require other federal agencies to justify their noise regulations with respect to the policy requirements of the federal Noise Control Act, each federal agency retains authority to adopt noise regulations pertaining to agency programs. The Occupational Safety and Health Administration (OSHA) has primary authority for setting workplace noise exposure standards. Due to aviation safety considerations, the FAA has primary jurisdiction over aircraft noise standards.

#### *Oregon State Legislation*

Oregon was one of the first states to adopt noise control regulations for airports, industry, racetracks, and motor vehicles. The regulations establish standards, provide exception and variance procedures, and provide enforcement. In the 1970s and 1980s, Oregon's Department of Environmental Quality (DEQ) participated in the local comprehensive land use plan development process to ensure noise issues were addressed and that local plans

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acknowledged the state regulations. A number of local governments have adopted their own noise control standards, or have adopted DEQ regulations by reference.

The DEQ, upon Legislative approval, terminated the Noise Control Program in July 1991 as an agency cost-savings measure due to reduction in General Fund support. Upon termination, DEQ took the necessary steps to inform local governments and the public, and provided guidance on how the statutes and rules would continue to apply. Additionally, DEQ provided local governments training on developing local noise ordinances and enforcement strategies. More details are included in other documents in Volume II.

### ***Washington County Legislation***

Other than land use planning ordinances for new projects as mentioned above, Washington County has not maintained county noise regulations in a consistent, effective therefore enforceable manner. The general county noise ordinance is woefully outdated as it only contains subjective descriptions of probable annoying noise emissions which most, including past and current County Counsels, consider unenforceable. The current noise ordinance is reviewed in detail in other sections of the report. Recently a new Washington County ordinance was adopted regulating dog barking. This novel ordinance even includes methods of citizen citations. This ordinance is commendable and a good example of how the committee would like Washington County to address the long standing weaknesses of the current general county noise ordinance.

Even though the current county ordinance lacks specific quantifiable noise measurement limits, the state regulations are applicable throughout the county and Washington County deputies are authorized to enforce state regulations such as vehicle noise emission limits. Additionally, the county is authorized by federal and state regulations to adopt regulations that prohibit specific type of noise generating devices such as jake brakes.

## **How Do We Ban Jake Brakes?**

**[www.nonoise.org](http://www.nonoise.org)**

If you live near a downward slope, or if you live near a place where trucks need to slow down (e.g. a highway exit ramp), you may be subjected to air compression brake noise. The noise you hear is a long, low, rumble that is often confused with the sound of trucks downshifting.

"Jake Brakes" is the brand name for air compression brakes. Many people do not realize that Jake Brakes can be deactivated. The Jake Brake is actually an alternative method of braking.

Here's how it works: The engine's pistons normally compress air and fuel using energy from the vehicle's wheels, and the energy from the explosion of the ignited fuel mixture forces the piston down and returns energy to the wheels.

Jake Brakes cut the fuel to the engine but still compress the air, using energy from the vehicle's turning wheels. This time the compressed air is exhausted and does not force the piston back down, so there is no energy returned to the wheels. This slows down the vehicle. Many drivers do it to save wear on the foot-brake, which then doesn't need replacing as often - say only once in five years instead of four. If you want to learn more about Jake Brakes, see their website at: <http://www.jakebrake.com>

The point is, the use of Jake Brakes is optional, and the use of Jake Brakes can be banned in your town. Cities and towns, such as Santa Fe, New Mexico, have outlawed the use of these brakes within their city limits. Most of the time the city will post a sign on major routes into the city to tell drivers passing through that jake brakes are not allowed. To learn more about other cities and towns and methods of notification search the NPC Noise News database.

## Walking/Biking in Washington County Could be Injurious to Hearing Health

**Roger M. Ellingson**

The sidewalks and bikelanes along many Washington County streets are no longer safe for healthy pedestrian and bicycle use. Although there might be a growing number of bike lanes and sidewalks in the county, many of the existing on-street facilities are no longer safe or healthy to walk or bike along due to excessive vehicle speeds and noise emissions. Study of the issue over the past years, has found the primary reasons for increased, damaging noise levels are: 1) Increased vehicle speeds, both legal and illegal, and decreased speed enforcement, 2) increasing numbers of illegally muffled vehicles and zero enforcement of noise emission laws for various reasons.

A series of noise measurements were performed along SW Barnes Road in late summer 2003. From these measurements the noise level pedestrians and bicyclists are exposed to walking along Barnes Road were calculated. The exposures exceed the health and safety limits set by the National Institute for Occupational Safety and Health. Results indicate if hearing protection devices are not worn while walking and biking along Barnes Road, hearing will be cumulatively damaged. The following table estimates the excessive noise exposure one might incur while taking a one hour round trip walk from St. Vincent's Hospital up to Miller/Barnes Shopping Center if hearing protection is not worn. The sidewalk is 5 feet wide and right next to the travel lane. The duration and types of events are typical for a summer day. It can be seen from the table that the cumulative noise exposure exceeds the recommended OSHA 8 Hour Maximum Noise Exposure Limit by 888%!

The situation is particularly dangerous for infants sitting in baby strollers near street level which places them very close to passing motorcycle and vehicle exhaust system tailpipes. If a baby is sitting on the corner at a stop light waiting to be pushed across, one unmuffled motorcycle could permanently damage the hearing health of this baby due to the nearness of the tailpipe to the baby's ears.

For reference, vehicle noise emissions increase roughly 3-10dB for every 10mph increase in speed, and sound level increases by a factor of two as the distance between the ear and noise source is halved.

<b>Estimated Vehicle Noise Exposure Per 1 Hour Barnes Road Walk</b>					
Vehicle Noise Source	Vehicle Loudness dBA (Slow)	OSHA 8 Hour Maximum Exposure Limit Seconds	1 Hour Walk Typical Noise Event Duration Seconds	Amount Barnes Road Event Exceeds OSHA Limits	Cumulative Noise Exposure Exceeding OSHA Limits
Police Siren	121	7	7	0%	0%
Heavy truck	120	9	30	333%	333%
Jake Brake	120	9	20	222%	555%
Illegal Harley Davidson	124	3	10	333%	888%

Reference: Table 1-1 "Combinations of noise exposure levels and durations that no worker exposure shall equal or exceed.", <http://www.cdc.gov/niosh/98-126a.html>.

## State of Oregon

### Department of Environmental Quality Noise Control Program

**Background:** Oregon was one of the first states to adopt noise control regulations for airports, industry, racetracks, and motor vehicles. The regulations establish standards, provide exception and variance procedures, and provide enforcement. DEQ program responsibilities included technical assistance, education and public awareness, responding to complaints, and carrying out enforcement activities. The statute gives the Environmental Quality Commission (EQC) authority to withdraw enforcement of the state regulations in jurisdictions that have adopted noise regulations that meet or exceed the state regulations. The EQC has never exercised this authority. In the 1970s and 1980s, DEQ participated in the local comprehensive land use plan development process to ensure noise issues were addressed and that local plans acknowledged the state regulations. A number of local governments have adopted their own noise control standards, or have adopted DEQ's regulations by reference.

**Program Termination:** The DEQ, upon Legislative approval, terminated the Noise Control Program in July 1991 as an agency cost-savings measure due to reduction in General Fund support. Upon termination, DEQ took the necessary steps to inform local governments and the public, and provided guidance on how the statutes and rules would continue to apply. Additionally, DEQ provided local governments training on developing local noise ordinances and enforcement strategies.

**Enforcement of State Noise Regulations:** Although DEQ's Noise Control Program has been terminated, the noise statutes and administrative rules remain in force. Regulated noise sources are legally responsible for complying with the state noise laws. The noise statutes are in ORS Chapter 467 and administrative rules in OAR 340 Division 35. Enforcement now falls under the responsibility of local governments, and in some cases, other agencies. Options available to local governments and the public include:

- Local governments may enact and enforce the State standards, or may adopt their own standards and enforcement, as long as the standards are consistent with or exceed the State standards.
- In some cases, a private citizen or local government may bring a nuisance suit through private legal counsel or local district attorney's office.
- A local government may submit evidence of a state noise violation to the local district attorney's office, and enforcement would be at the discretion of that office.
- The Energy Facility Siting Council (EFSC), under the Department of Energy, is authorized to approve the siting of large energy facilities in the State. EFSC staff review applications to ensure that proposed facilities meet the State noise regulations. Smaller energy facilities that are exempt from EFSC's authority may be subject to county noise regulations, and must also comply with the State regulations.

**Staff Response to Noise Related Inquiries:** There is no longer a state noise program and funding for DEQ to respond to complaints, provide advice, or interpret the State noise regulations. DEQ must ensure that its resources are only spent on programs approved by the Legislature. Staff response to noise related inquiries need to be limited to the following:

1. Explain that the noise program was terminated and that DEQ has no authority or resource to work on noise issues or respond to noise complaints.
2. Citizen inquiries should be directed to the affected local government planning department or agency.

<http://www.deq.state.or.us/aq/noise/>

### Finding Solutions to Noise Problems

Effective July 1, 1991, the state Department of Environmental Quality (DEQ) Noise Control Program was terminated. DEQ eliminated the program as a cost-saving measure, in anticipation of reduced revenue.

## **Were the State Noise Regulations Rescinded?**

No. The state noise regulations remain on the books. Regulated sources of noise are legally responsible for complying with all applicable provisions and standards, even though DEQ no longer investigates noise complaints.

## **What Types of State Noise Standards Are There?**

State regulations have standards for:

- New and used motor vehicles
- Industry and commerce
- Motor sports vehicles and facilities
- Airports

## **What Other Agencies Investigate Noise Problems?**

Several Oregon cities and counties have enacted local noise ordinances. Other state and federal agencies also regulate noise.

For example, the State Marine Board regulates noise from boats, with enforcement of suspected boat-noise violations handled primarily through county marine enforcement offices; the Oregon Liquor Control Commission regulates noise from licensed liquor establishments.

## **What Other Enforcement Options are There?**

- Enforcement of local government noise or public nuisance ordinances.
- Class B misdemeanor criminal action for violation of the state noise statutes or the state disorderly misconduct statutes.

## **What Types of Local Noise Standards are There?**

Standards vary from city to city and county to county. Some jurisdictions use the state standards; others have enacted separate standards. A couple of cities have standards that are more stringent than the state's. In general, most local regulations include standards for:

- Heat pumps and air conditioner units
- Amplified music from musical groups and car stereos
- Off-road ATVs, motorcycles, and dune buggies
- Loud speakers
- Musical instruments

## **Who Enforces Local Standards?**

Generally, the county sheriff and city police departments investigate noise complaints and initiate enforcement actions. In some cases, the local codes enforcement office assumes this responsibility.

## **Where Can I Get Information on Noise Pollution?**

- [Statutes, ORS Chapter 467, Noise Control](#)
- [Oregon Administrative Rules, \(see Division 35 Noise Control Regulations\)](#)
- [The Noise Pollution Clearinghouse](#) or 1-888-200-8332.

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Hard copies of the state noise regulations are also available from DEQ headquarters, or by contacting your [regional DEQ office](#).

**Federal Law**

**EPA Vehicle Noise Emission Limits**

Source: <http://www.fhwa.dot.gov/environment/polguid.pdf>

The Noise Control Act of 1972 gives the Federal Environmental Protection Agency (EPA) the authority to establish noise regulations to control major sources of noise, including transportation vehicles and construction equipment. In addition, this legislation requires EPA to issue noise emission standards for motor vehicles used in Interstate commerce (vehicles used to transport commodities across State boundaries) and requires the FHWA office of Motor Carrier Safety (OMCS) to enforce these noise emission standards. The EPA has established regulations which set emission level standards for newly manufactured medium and heavy trucks that have a gross vehicle weight rating (GVWR) of more than 4,525 kilograms and are capable of operating on a highway or street. Table 1 shows the maximum noise emission levels allowed by the EPA noise regulations for these vehicles.

**Table 1: Maximum Noise Emission Levels as Required by EPA for Newly Manufactured Trucks with GVWR Over 4,525 Kilograms**

Effective Date	Maximum Noise Level 15 Meters from Centerline of Travel*
January 1, 1988	80 dBA

\* Using the Society of Automotive Engineers, Inc. (SAE), test procedure for acceleration under 56 kph

For existing (in-use) medium and heavy trucks with a GVWR of more than 4,525 kilograms, the Federal government has authority to regulate the noise emission levels only for those that are engaged in interstate commerce. Regulation of all other in-use vehicles must be done by State or local governments. The EPA emission level standards for in-use medium and heavy trucks engaged in interstate commerce are shown in Table 2 and are enforced by the FHWA OMCS.

**Table 2: Maximum Noise Emission Levels as Required by EPA for In-Use Medium and Heavy Trucks with GVWR Over 4,525 Kilograms Engaged in Interstate Commerce**

Effective Date	Speed	Maximum Noise Level 15 Meters from Centerline of Travel
January 8, 1986	< 56 kph	83 dBA
January 8, 1986	> 56 kph	87 dBA
January 8, 1986	Stationary	85 dBA

Several federal laws require the federal government to provide uniform standards for various sources of noise. The responsibility for setting and enforcing these standards is divided among multiple federal agencies. In the past, the Environmental Protection Agency (EPA) coordinated all federal noise control activities through its Office of Noise Abatement and Control. However, Congress phased out the office’s funding in FY1983 as part of a shift in federal noise control policy to transfer the primary responsibility of regulating noise to state and local governments. Although EPA no longer plays a prominent role in regulating noise, its past standards and regulations remain in effect, and other federal agencies continue to set and enforce noise standards for sources within their regulatory jurisdiction.

**Interstate Motor Carriers.** The Noise Control Act required EPA to develop noise standards for motor carriers engaged in interstate commerce, and it authorized the Federal Highway Administration to enforce them[42 U.S.C. 4917]. All commercial vehicles over 10,000 pounds are subject to standards for highway travel and stationary

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peration, but the standards do not apply to sounds from horns or sirens when operated as warning devices for safety purposes. For highway travel, the standards range from 81 to 93 dBA, depending on the speed of the vehicle and the distance from which the sound is measured. The standards for stationary operation are similar and range from 83 to 91 dBA, depending on the distance from the vehicle. The standards apply at any time or condition of highway grade, vehicle load, acceleration, or deceleration.

## Interstate Motor Carrier Regulation-Federal-State Regulations

49 USC § 14501

### Chapter 145 - Federal-State Regulations

CITE 49 USC CHAPTER 145 - FEDERAL-STATE RELATIONS 01/06/97  
EXPCITE TITLE 49 - TRANSPORTATION  
SUBTITLE IV - INTERSTATE TRANSPORTATION  
PART B - MOTOR CARRIERS, WATER CARRIERS, BROKERS, AND FREIGHT  
FORWARDERS  
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.  
TEXT CHAPTER 145 - FEDERAL-STATE RELATIONS  
NOTES Sec.  
14501. Federal authority over intrastate transportation.  
14502. Tax discrimination against motor carrier transportation  
property.

...

CITE 49 USC Sec. 14501 01/06/97  
EXPCITE TITLE 49 - TRANSPORTATION  
SUBTITLE IV - INTERSTATE TRANSPORTATION  
PART B - MOTOR CARRIERS, WATER CARRIERS, BROKERS, AND FREIGHT  
FORWARDERS  
CHAPTER 145 - FEDERAL-STATE RELATIONS  
TEXT Sec. 14501. Federal authority over intrastate transportation  
(a) Motor Carriers of Passengers. - No State or political  
subdivision thereof and no interstate agency or other political  
agency of 2 or more States shall enact or enforce any law, rule,  
regulation, standard, or other provision having the force and  
effect of law relating to scheduling of interstate or intrastate  
transportation (including discontinuance or reduction in the level  
of service) provided by motor carrier of passengers subject to  
jurisdiction under subchapter I of chapter 135 of this title on an  
interstate route or relating to the implementation of any change in  
the rates for such transportation or for any charter transportation  
except to the extent that notice, not in excess of 30 days, of  
changes in schedules may be required. This subsection shall not  
apply to intrastate commuter bus operations.  
(b) Freight Forwarders and Brokers. -  
(1) General rule. - Subject to paragraph (2) of this  
subsection, no State or political subdivision thereof and no  
intrastate agency or other political agency of 2 or more States  
shall enact or enforce any law, rule, regulation, standard, or  
other provision having the force and effect of law relating to  
intrastate rates, intrastate routes, or intrastate services of  
any freight forwarder or broker.  
(2) Continuation of hawaii's authority. - Nothing in this  
subsection and the amendments made by the Surface Freight  
Forwarder Deregulation Act of 1986 shall be construed to affect  
the authority of the State of Hawaii to continue to regulate a  
motor carrier operating within the State of Hawaii.  
(c) Motor Carriers of Property. -  
(1) General rule. - Except as provided in paragraphs (2) and  
(3), a State, political subdivision of a State, or political  
authority of 2 or more States may not enact or enforce a law,  
regulation, or other provision having the force and effect of law  
related to a price, route, or service of any motor carrier (other  
than a carrier affiliated with a direct air carrier covered by  
section 41713(b)(4)) or any motor private carrier, broker, or  
freight forwarder with respect to the transportation of property.  
(2) Matters not covered. - Paragraph (1) -  
(A) shall not restrict the safety regulatory authority of a

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State with respect to motor vehicles, the authority of a State to impose highway route controls or limitations based on the size or weight of the motor vehicle or the hazardous nature of the cargo, or the authority of a State to regulate motor carriers with regard to minimum amounts of financial responsibility relating to insurance requirements and self-insurance authorization;

(B) does not apply to the transportation of household goods; and

(C) does not apply to the authority of a State or a political subdivision of a State to enact or enforce a law, regulation, or other provision relating to the price of for-hire motor vehicle transportation by a tow truck, if such transportation is performed without the prior consent or authorization of the owner or operator of the motor vehicle.

(3) State standard transportation practices. -

(A) Continuation. - Paragraph (1) shall not affect any authority of a State, political subdivision of a State, or political authority of 2 or more States to enact or enforce a law, regulation, or other provision, with respect to the intrastate transportation of property by motor carriers, related to -

(i) uniform cargo liability rules,

(ii) uniform bills of lading or receipts for property being transported,

(iii) uniform cargo credit rules,

(iv) antitrust immunity for joint line rates or routes, classifications, mileage guides, and pooling, or

(v) antitrust immunity for agent-van line operations (as set forth in section 13907), if such law, regulation, or provision meets the requirements of subparagraph (B).

(B) Requirements. - A law, regulation, or provision of a State, political subdivision, or political authority meets the requirements of this subparagraph if -

(i) the law, regulation, or provision covers the same subject matter as, and compliance with such law, regulation, or provision is no more burdensome than compliance with, a provision of this part or a regulation issued by the Secretary or the Board under this part; and

(ii) the law, regulation, or provision only applies to a carrier upon request of such carrier.

(C) Election. - Notwithstanding any other provision of law, a carrier affiliated with a direct air carrier through common controlling ownership may elect to be subject to a law, regulation, or provision of a State, political subdivision, or political authority under this paragraph.

(4) Nonapplicability to hawaii. - This subsection shall not apply with respect to the State of Hawaii.

SOURCE (Added Pub. L. 104-88, title I, Sec. 103, Dec. 29, 1995, 109 Stat. 899.)

### NOTES

#### REFERENCES IN TEXT

The Surface Freight Forwarder Deregulation Act of 1986, referred to in subsec. (b) (2), is Pub. L. 99-521, Oct. 22, 1986, 100 Stat. 2993. For complete classification of this Act to the Code, see Short Title of 1986 Amendment note set out under section 10101 of this title and Tables.

#### PRIOR PROVISIONS

Provisions similar to those in this section were contained in section 11501 of this title prior to the general amendment of this subtitle by Pub. L. 104-88, Sec. 102(a).

#### EFFECTIVE DATE

Chapter effective Jan. 1, 1996, except as otherwise provided in Pub. L. 104-88, see section 2 of Pub. L. 104-88, set out as a note under section 701 of this title.

### SECRET

#### SECTION REFERRED TO IN OTHER SECTIONS

## Final Report Volume II. Resource Documents

This section is referred to in section 13902 of this title.

## Interstate Motor Carrier Regulation-Engagement in Interstate Commerce

[Code of Federal Regulations]  
[Title 40, Volume 16, Parts 190 to 259]  
[Revised as of July 1, 1998]  
[CITE: 40CFR202.12]

[Page 73]

### TITLE 40--PROTECTION OF ENVIRONMENT

#### CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

#### PART 202--MOTOR CARRIERS ENGAGED IN INTERSTATE COMMERCE--Table of Contents

##### Subpart A--General Provisions

##### Sec. 202.12 Applicability.

(a) The provisions of Subpart B apply to all motor carriers engaged in interstate commerce.

(b) The provisions of Subpart B apply only to those motor vehicles of such motor carriers which have a gross vehicle weight rating or gross combination weight rating in excess of 10,000 pounds, and only when such motor vehicles are operating under the conditions specified in Subpart B.

(c) Except as provided in paragraphs (d) and (e) of this section, the provisions of Subpart B apply to the total sound produced by such motor vehicles when operating under such conditions, including the sound produced by auxiliary equipment mounted on such motor vehicles.

(d) The provisions of Subpart B do not apply to auxiliary equipment which is normally operated only when the transporting vehicle is stationary or is moving at a speed of 5 miles per hour or less. Examples of such equipment include, but are not limited to, cranes, asphalt spreaders, ditch diggers, liquid or slurry pumps, air compressors, welders, and trash compactors.

(e) The provisions of Subpart B do not apply to warning devices, such as horns and sirens; or to emergency equipment and vehicles such as fire engines, ambulances, police vans, and rescue vans, when responding to emergency calls; or to snow plows when in operation.

(f) The provisions of Sec. 202.20(a) and Sec. 202.21(a) of Subpart B apply only to applicable motor vehicles manufactured prior to the 1986 model year.

(g) The provisions of Sec. 202.20(b) and Sec. 202.21(b) apply to all applicable motor vehicles manufactured during or after the 1986 model year.

[39 FR 38215, Oct. 29, 1974, as amended at 51 FR 852, Jan. 8, 1986]

[Code of Federal Regulations]  
[Title 40, Volume 16, Parts 190 to 259]  
[Revised as of July 1, 1998]  
[CITE: 40CFR202.20]

## Interstate Motor Carrier Regulation-Vehicle Operation Standards

[Page 73]

TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

PART 202--MOTOR CARRIERS ENGAGED IN INTERSTATE COMMERCE--Table of Contents

Subpart B--Interstate Motor Carrier Operations Standards

Sec. 202.20 Standards for highway operations.

(a) No motor carrier subject to these regulations shall operate any motor vehicle of a type to which this regulation is applicable which at any time or under any condition of highway grade, load, acceleration or deceleration generates a sound level in excess of 86dB(A) measured on an open site with fast meter response at 50 feet from the centerline of lane of travel on highways with speed limits of 35 MPH or less; or 90 dB(A) measured on an open site with fast meter response at 50 feet from the centerline of lane of travel on highways with speed limits of more than 35 MPH.

(b) No motor carrier subject to these regulations shall operate any motor vehicle of a type to which this regulation is applicable which at any time or under any condition of highway grade, load, acceleration or deceleration generates a sound level in excess of 83 dB(A) measured on an open site with fast meter response at 50 feet from the centerline of lane of travel on highways with speed limits of 35 MPH or less; or 87 dB(A) measured on an open site with fast meter response at 50 feet from the centerline of lane of travel on highways with speed limits of more than 35 MPH.

[39 FR 38215, Oct. 29, 1974, as amended at 51 FR 852, Jan. 8, 1986]

## Oregon Interstate Motor Carrier Regulations-Motor Carrier Enforcement

### Oregon Administrative Rule 340-035-0030

(c) Trucks Engaged in Interstate Commerce. Motor vehicles with a GVWR or GCWR in excess of 10,000 pounds which are engaged in interstate commerce by trucking and are regulated by **Part 202** of **Title 40** of the **Code of Federal Regulations**, promulgated pursuant to Section 17 of the Noise Control Act of 1972, 86 Stat. 1248, Public Law 92-574, shall be:

(A) Free from defects which adversely affect sound reduction;

(B) Equipped with a muffler or other noise dissipative device;

(C) Not equipped with any "cut-out" devices, "by-pass" devices, or any other similar devices; and

(D) Not equipped with any tire which as originally manufactured or newly retreaded has a tread pattern composed primarily of cavities in the tread, excluding sipes and local chunking, not vented by grooves to the tire shoulder or vented circumferentially to each other around the tire.

## **Summary of Federal Interstate Motor Carrier Noise Emission Regulations**

Standards for new motor vehicle noise emissions are set by Title 40, Chapter 1, Part 205 of the Code of Federal Regulations and are summarized below.

### Cars

US: No standard

### Medium Trucks

US: 83 (1979-1988) or 80 (1988 and later)

### Heavy Trucks

US: 83 (1979-1988) or 80 (1988 and later)

Europe: 91 (1972) 88 (1982) 84 (1988/90) or 80 (1995/96) Mopeds (engine < 80 cc)

US: 70 (1983 and later)

Europe: 78 (1980) 77 (1989) or 75 (Proposal)

### Large Motorcycles

US: 86 (1983-1986) or 82 (1986 and later)

For more information look at the applicable U.S. law at:

TRANSPORTATION EQUIPMENT NOISE EMISSION CONTROLS

<http://www.nonoise.org/lawlib/cfr/40>

## Federal Motor Carrier Safety Regulations

### Federal Motor Carrier Safety Regulations

<http://www.fmcsa.dot.gov/rulesregs/fmcsr/regs/325.htm>

#### Scope of the Rules in This Part

The rules in part 325 prescribe procedures for inspection, surveillance, and measurement of motor vehicles and motor vehicle equipment operated by motor carriers to determine whether those vehicles and that equipment conform to the Interstate Motor Carrier Noise Emission Standards of the Environmental Protection Agency, 49 CFR Part 202. Except as provided in next paragraph, the rules in this Part apply to motor carriers engaged in Interstate Commerce. The rules apply at any time or under any condition of highway grade, load, acceleration or deceleration.

The rules in this part do not apply to a motor vehicle that has a Gross Vehicle Weight Rating (GVWR) of 10,000 pounds (4,536 kg) or less, a combination of motor vehicles that has a Gross Combination Weight Rating (GCWR) of 10,000 pounds (4,536 kg) or less, the sound generated by a warning device, such as a horn or siren, installed in a motor vehicle, unless such device is intentionally sounded in order to preclude an otherwise valid noise emission measurement, an emergency motor vehicle, such as a fire engine, an ambulance, a police van, or a rescue van, when it is responding to an emergency call, a snow plow in operation, or the sound generated by auxiliary equipment which is normally operated only when the motor vehicle on which it is installed is stopped or is operating at a speed of 5 miles per hour (8 kph) or less, unless such device is intentionally operated at speeds greater than 5 mph (8 kph) in order to preclude an otherwise valid noise measurement. Examples of that type of auxiliary equipment include, but are not limited to, cranes, asphalt spreaders, ditch diggers, liquid or slurry pumps, auxiliary air compressors, welders, and trash compactors. See Section 325.1

Motor vehicle noise emissions, when measured according to the rules of this part, shall not exceed the values specified in table in Section [325.7](#).

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**§Sec. 325.7 - Allowable noise levels.**

Motor vehicle noise emissions, when measured according to the rules of this part, shall not exceed the values specified in Table 1.

Table 1--Maximum Permissible Sound Level Readings (Decibel (A)) \1, 2\

	Highway operation test				Stationary tests	
	Soft site		Hard Site		Soft site	Hard site
	35 mi/h or less	Above 35 mi/h	35 mi/h or less	Above 35 mi/h		
If the distance between the microphone location point and the microphone target point is--						
31 ft ( 9.5m) or more but less than	87	91	89	93	89	91
35 ft (10.7m).....						
35 ft (10.7m) or more but less than	86	90	88	92	88	90
39 ft (11.9m).....						
39 ft (11.9m) or more but less than	85	89	87	91	87	89
43 ft (13.1m).....						
43 ft (13.1m) or more but less than	84	88	86	90	86	88
48ft (14.6m).....						
48 ft (14.6m) or more but less than	83	87	85	89	85	87
58 ft (17.1m).....						
58 ft (17.1m) or more but less than	82	86	84	88	84	86
70 ft (21.3m).....						
70 ft (21.3m) or more but less than	83	81	85	83	87	83
85 ft (25.3m).....						

\1\ The speeds shown refer to measurements taken at sites having speed limits as indicated. These speed limits do not necessarily have to be posted.  
 \2\ This table is based on motor carrier noise emission requirements specified in 40 CFR 202.20 and 40 CFR 202.21.  
 [40 FR 42437, Sept. 12, 1975, as amended at 54 FR 50385, Dec. 6, 1989]

## **Interstate Motor Carrier Regulation Opinion**

Reference: <http://www.westerncity.com/SEP02LegalNotes.htm>

### **Local Safety Regulation of Tow Trucks Upheld**

Cities breathed a collective sigh of relief when the U.S. Supreme Court concluded that federal law does not preclude municipalities from imposing safety regulations on tow truck operators. Federal law generally prevents states and their subdivisions from regulating the price, route or service of motor carriers transporting property. See 49 U.S.C. section 14501(c). However, an exception allows state's regulations for safety. See 49 U.S.C. section 14501(c)(2)(A).

The city regulation in question required tow truck operators to obtain city licenses, submit to city inspections and meet other city standards. The Supreme Court concluded that the purpose of the federal law was to pre-empt states' economic authority over motor carriers of property, such as tow trucks, not to restrict traditional state police power over safety. The city was trying to regulate the safety of the vehicles by establishing standards. The court also determined that states could delegate authority to municipalities for establishing safety regulations related to motor carriers or property, including tow trucks. *City of Columbus v. Ours Garage and Wrecker Service, Inc.*, \_\_\_ U.S. \_\_\_, 112 S. Ct. 2226 (2002).

Final Report Volume II. Resource Documents  
**Oregon Department of Environmental Quality**  
**Oregon Administrative Rule Division 35**

## **Implementation of ORS 467 Noise Control Regulations**

Excerpted from: [http://arcweb.sos.state.or.us/rules/OARs\\_300/OAR\\_340/340\\_035.html](http://arcweb.sos.state.or.us/rules/OARs_300/OAR_340/340_035.html)

### **340-035-0005 Policy**

In the interest of public health and welfare, and in accordance with [ORS 467.010](#), it is declared to be the public policy of the State of Oregon:

- (1) To provide a coordinated state-wide program of noise control to protect the health, safety, and welfare of Oregon citizens from the hazards and deterioration of the quality of life imposed by excessive noise emissions;
- (2) To facilitate cooperation among units of state and local governments in establishing and supporting noise control programs consistent with the state program and to encourage the enforcement of viable local noise control regulations by the appropriate local jurisdiction;
- (3) To develop a program for the control of excessive noise sources which shall be undertaken in a progressive manner, and each of its objectives shall be accomplished by cooperation among all parties concerned.

### **340-035-0025**

#### **Noise Control Regulations for the Sale of New Motor Vehicles**

(1) Standards and Regulations:

- (a) No person shall sell or offer for sale any new motor vehicle designated in this rule which produces a propulsion noise exceeding the noise limits specified in **Table 1**, except as otherwise provided in these rules.
- (b) Subsequent to the adoption of a Federal Environmental Protection Agency procedure to determine sound levels of passenger cars and light trucks, or a nationally accepted procedure for these vehicles not similar to those specified and approved under subsection (2)(a) of this rule, the Department shall conduct an evaluation under such new procedure.
- (c) After an appropriate evaluation of noise emission data measured under the procedure specified under subsection (1)(b) of this rule, the Department shall make recommendations to the Commission on the adequacy of the procedure and the necessity of amendments to this rule for incorporation of the procedure and associated standards.
- (d) No person shall sell or offer to sell any new motorcycle, new motorcycle exhaust system or new motorcycle exhaust system component manufactured after January 1, 1983 unless the motorcycle, exhaust system, or exhaust component is properly labeled or marked in accordance with federal noise regulations specified in Part 205 **Subpart E** of **Title 40** of the **Code of Federal Regulations**.

### **340-035-0030**

#### **Noise Control Regulations For In-Use Motor Vehicles**

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(1) Standards and Regulations:

(a) Road Vehicles:

(A) No person shall operate any road vehicle which exceeds the noise level limits specified in **Table 2** or in such a manner to exceed the noise level limits specified in Table 3, except as otherwise provided in these rules.

(B) No person shall operate a road vehicle with any of the following defects:

(i) No muffler;

(ii) Leaks in the exhaust system;

(iii) Pinched outlet pipe.

.....

(c) Trucks Engaged in Interstate Commerce. Motor vehicles with a GVWR or GCWR in excess of 10,000 pounds which are engaged in interstate commerce by trucking and are regulated by **Part 202 of Title 40 of the Code of Federal Regulations**, promulgated pursuant to Section 17 of the Noise Control Act of 1972, 86 Stat. 1248, Public Law 92-574, shall be:

(A) Free from defects which adversely affect sound reduction;

(B) Equipped with a muffler or other noise dissipative device;

(C) Not equipped with any "cut-out" devices, "by-pass" devices, or any other similar devices; and....

(f) Motorcycles manufactured after December 31, 1982 to Federal Noise Regulations (**40 CFR Part 205**):

(A) No person shall remove or render inoperative, or cause to be removed or rendered inoperative, other than for the purposes of maintenance, repair, or replacement of any device or element of design incorporated in the motorcycle for the purpose of noise control;

(B) No person shall remove or deface any noise label or mark required by federal law which is affixed to any motorcycle or motorcycle part for purposes of identifying the motorcycle or motorcycle part as a federally regulated product;

(C) No person shall operate any road or off-road motorcycle manufactured to federal noise law that does not bear a label or mark on the exhaust system that matches the model specific code of the motorcycle on which the system is installed;

(D) No person shall operate, nor shall any person cause, allow, permit or fail to control the operation of any competition motorcycle identified for "competition use only" by the noise label or mark required by federal law on any property other than a motor sports facility in a practice session or a racing event;

(E) No person shall operate, nor shall any person cause, allow, permit or fail to control the operation of any motorcycle fitted with an exhaust system or exhaust system component identified for "competition motorcycles only" by the noise label or mark required by federal law on any property other than a motor sports facility in a practice session or a racing event.

**Table 2 (340-35-030) IN-USE ROAD VEHICLE STANDARDS**

**Stationary Test**

<b>Vehicle Type</b>	<b>Model Year</b>	<b>Maximum Noise Level, dBA</b>	<b>Minimum Distance From Vehicle to Measurement Point</b>
All vehicles described in ORS 481.205(2)(a)	Before 1976	94	25 feet (7.6 meters)
	1976 and After	91	25 feet (7.6 meters)
All other trucks in excess of 8,000 pounds (3629 kg) GVWR	Before 1976	94	25 feet (7.6 meters)
	1976-1981	91	25 feet (7.6 meters)
	After 1981	88	25 feet (7.6 meters)
Motorcycles	1975 and Before	102	20 inches (1/2 meter)
	After 1975	99	20 inches (1/2 meter)
Front-engine automobiles, light trucks and all other front-engine road vehicles	All	95	20 inches (1/2 meter)
Rear-engine automobiles and light trucks and mid-engine automobiles and light trucks	All	97	20 inches (1/2 meter)
Buses and defined under ORS 481.030	Before 1976	94	25 feet (7.6 meters)
	1976 and after	91	25 feet (7.6 meters)

**Table 3 (340-35-030) IN-USE ROAD VEHICLE STANDARDS**

**Moving Test at 50 ft. (15.2 Meters) or Greater at Vehicle Speed**

<b>Operating Conditions</b>	<b>Trucks and Buses exceeding 10,000 pounds GVWR</b>	<b>Automobiles and light trucks</b>	<b>Motor-cycles</b>
Posted 45 mph or less under any grade, load, acceleration or deceleration.	86	72	78
Posted greater than 45 mph under any grade, load, acceleration or deceleration.	90	78	82
Moving at 35 mph or less on level roadway under constant speed more than 200 feet from stop.	84	70	74

## Oregon State Statute 467-Relating to Noise Control

Reference: <http://landru.leg.state.or.us/ors/467.html>

### Chapter 467 — Noise Control 2001 EDITION

**467.010 Legislative findings and policy.** The Legislative Assembly finds that the increasing incidence of noise emissions in this state at unreasonable levels is as much a threat to the environmental quality of life in this state and the health, safety and welfare of the people of this state as is pollution of the air and waters of this state. To provide protection of the health, safety and welfare of Oregon citizens from the hazards and deterioration of the quality of life imposed by excessive noise emissions, it is hereby declared that the State of Oregon has an interest in the control of such pollution, and that a program of protection should be initiated. To carry out this purpose, it is desirable to centralize in the Environmental Quality Commission the authority to adopt reasonable statewide standards for noise emissions permitted within this state and to implement and enforce compliance with such standards. [1971 c.452 §1]

**467.020 Emission of noise in excess of prescribed levels prohibited.** Except as provided in ORS 467.131 and 467.133, no person may emit, cause the emission of, or permit the emission of noise in excess of the levels fixed therefore by the Environmental Quality Commission pursuant to ORS 467.030. [1971 c.452 §3; 1995 s.s. c.3 §40c; 1996 c.8 §2]

**467.030 Adoption of noise control rules, levels and standards.** (1) In accordance with the applicable provisions of ORS 183.310 to 183.550, the Environmental Quality Commission shall adopt rules relating to the control of levels of noise emitted into the environment of this state and including the following:

- (a) Categories of noise emission sources, including the categories of motor vehicles and aircraft.
  - (b) Requirements and specifications for equipment to be used in the monitoring of noise emissions.
  - (c) Procedures for the collection, reporting, interpretations and use of data obtained from noise monitoring activities.
- (2) The Environmental Quality Commission shall investigate and, after appropriate public notice and hearing, shall establish maximum permissible levels of noise emission for each category established, as well as the method of measurement of the levels of noise emission.
- (3) The Environmental Quality Commission shall adopt, after appropriate public notice and hearing, standards for the control of noise emissions which shall be enforceable by order of the commission.
- (4) In adopting noise control rules, levels and standards under this section, the Environmental Quality Commission shall not adopt any rule that would impose liability for any activity for which immunity from civil and criminal liability is granted or for which an action for nuisance is prohibited under ORS 467.131 and 467.133. [1971 c.452 §2; 1973 c.107 §1; 1973 c.835 §159; 1995 s.s. c.3 §40d; 1996 c.8 §4]

**Federal Law**

**EPA Vehicle Noise Emission Limits**

Source: <http://www.fhwa.dot.gov/environment/polguid.pdf>

The Noise Control Act of 1972 gives the Federal Environmental Protection Agency (EPA) the authority to establish noise regulations to control major sources of noise, including transportation vehicles and construction equipment. In addition, this legislation requires EPA to issue noise emission standards for motor vehicles used in Interstate commerce (vehicles used to transport commodities across State boundaries) and requires the FHWA office of Motor Carrier Safety (OMCS) to enforce these noise emission standards. The EPA has established regulations which set emission level standards for newly manufactured medium and heavy trucks that have a gross vehicle weight rating (GVWR) of more than 4,525 kilograms and are capable of operating on a highway or street. Table 1 shows the maximum noise emission levels allowed by the EPA noise regulations for these vehicles.

**Table 1: Maximum Noise Emission Levels as Required by EPA for Newly Manufactured Trucks with GVWR Over 4,525 Kilograms**

Effective Date	Maximum Noise Level 15 Meters from Centerline of Travel*
January 1, 1988	80 dBA

\* Using the Society of Automotive Engineers, Inc. (SAE), test procedure for acceleration under 56 kph

For existing (in-use) medium and heavy trucks with a GVWR of more than 4,525 kilograms, the Federal government has authority to regulate the noise emission levels only for those that are engaged in interstate commerce. Regulation of all other in-use vehicles must be done by State or local governments. The EPA emission level standards for in-use medium and heavy trucks engaged in interstate commerce are shown in Table 2 and are enforced by the FHWA OMCS.

**Table 2: Maximum Noise Emission Levels as Required by EPA for In-Use Medium and Heavy Trucks with GVWR Over 4,525 Kilograms Engaged in Interstate Commerce**

Effective Date	Speed	Maximum Noise Level 15 Meters from Centerline of Travel
January 8, 1986	< 56 kph	83 dBA
January 8, 1986	> 56 kph	87 dBA
January 8, 1986	Stationary	85 dBA

Several federal laws require the federal government to provide uniform standards for various sources of noise. The responsibility for setting and enforcing these standards is divided among multiple federal agencies. In the past, the Environmental Protection Agency (EPA) coordinated all federal noise control activities through its Office of Noise Abatement and Control. However, Congress phased out the office’s funding in FY1983 as part of a shift in federal noise control policy to transfer the primary responsibility of regulating noise to state and local governments. Although EPA no longer plays a prominent role in regulating noise, its past standards and regulations remain in effect, and other federal agencies continue to set and enforce noise standards for sources within their regulatory jurisdiction.

**Interstate Motor Carriers.** The Noise Control Act required EPA to develop noise standards for motor carriers engaged in interstate commerce, and it authorized the Federal

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Highway Administration to enforce them[42 U.S.C. 4917]. All commercial vehicles over 10,000 pounds are subject to standards for highway travel and stationary operation, but the standards do not apply to sounds from horns or sirens when operated as warning devices for safety purposes. For highway travel, the standards range from 81 to 93 dBA, depending on the speed of the vehicle and the distance from which the sound is measured. The standards for stationary operation are similar and range from 83 to 91 dBA, depending on the distance from the vehicle. The standards apply at any time or condition of highway grade, vehicle load, acceleration, or deceleration.

## **Federal Highway Administration Noise Abatement Criteria (NAC)**

### **FHWA NOISE ABATEMENT CRITERIA (NAC) (Source: Cowan 1994)**

Category A: Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose

Leq(1) (dBA): 58 (exterior)

L10(1) (dBA): 60 (exterior)

Category B: Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals

Leq: 67 (exterior)

L10: 70 (exterior)

Category C: Developed lands, properties, or activities not included in categories A or B

Leq: 72 (exterior)

L10: 75 (exterior)

## City of Portland Motor Vehicle Noise Ordinance

<http://www.portlandonline.com/auditor/index.cfm?&a=18496&c=28709>

### 18.10.020 Motor Vehicles.

(Amended by Ord. No. 159276 and 164010, Mar. 27, 1991.)

**A.** No person shall operate any motor vehicle registered for use on public roads at any time, or under any condition of grade, load, acceleration or deceleration in such a manner as to violate the maximum permissible sound levels or equipment standards for the category of vehicle as indicated in this Subsection.

**1.** Vehicles of 10,000 pounds GCWR (Gross Combination Weight Rating) or more, engaged in interstate commerce as regulated by 40 C.F.R., part 202, (1986), the provisions of which are hereby incorporated by reference and three copies of which are on file in the Office of the City Auditor.

**2.** All other vehicles shall not exceed the vehicular noise emission levels or equipment standards permitted by OAR 340-35-030 (1) (a) and (c), three copies of which are on file in the Office of the City Auditor and which are hereby adopted by reference.

**3.** No person shall drive a motor vehicle on a public highway unless it is equipped with a muffler in good working order and in constant operation to prevent excessive or unusual noise.

**B.** No person shall operate, and no owner of any motor vehicle shall permit to be operated upon any public road, street, or highway, any motor vehicle so as to cause any greater noise or sound than is reasonably necessary for the proper operation of such motor vehicle.

**1.** No person shall operate a motor vehicle on a street or highway with an exhaust system utilizing a cutout, bypass or similar device.

**2.** No person shall operate a motor vehicle in such a manner as to cause or allow to be emitted squealing, screeching, or other such noise from the tires in contact with the ground because of rapid acceleration or excessive speed around corners or other such reason, except that noise resulting from emergency action to avoid imminent danger shall be exempt from this provision.

**3.** No person shall operate any motor vehicle in excess of 10,000 pounds GCWR, in any residential zone of the City or within 200 feet of any dwelling unit, school, hospital or library, with a dynamic braking device engaged except to avoid imminent danger.

**C.** No person shall operate and no owner of property shall permit the operation of an off-road vehicle so as to exceed the noise emission standards of:

**1.** OAR 35-030 (1)(b) and (d) three copies of which are on file with the Office of the City Auditor, and which are hereby adopted by reference.

**2.** Section 18.10.010 or 18.10.020 of this Title.

**D.** No person shall operate an off-road vehicle on private or public property unless the property has been designated for off-road recreational vehicle use pursuant to Title 33, Planning and Zoning of this Code.

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**E.** A police officer, or noise control officer, who finds a vehicle or operator to be in violation of Subsection A of this Section shall issue a citation to the operator. The citation shall be accompanied by a written notice to the operator specifying the particular subsections found to be in violation.

- 1.** The citation shall require the violator to appear at court to answer for the violation and present evidence that the violation has been corrected. The date for court appearance on the face of the citation shall not be less than 28 days after the citation was issued.
- 2.** The accompanying written notice shall specify that if the violator presents proof to the clerk of the district court that the vehicle complies with the standards described in OAR 340-35-030 (1), (a) and (c) (1983), for the control of motor vehicle noise emissions, three copies of which are on file with the Office of the City Auditor and which are hereby adopted by reference, the citation shall be dismissed.
- 3.** Proof for the purpose of this Section shall be a certificate of compliance issued or approved by the Department of Environmental Quality. If said certificate is received by the clerk of the district court not less than 5 days prior to the date set for the violator's appearance before the court, the citation will be dismissed without the necessity of the violator personally appearing before the court.

## **Beaverton Noise Code Outlawing Exhaust Brakes**

Reference: <http://municipalcodes.lexisnexis.com/codes/beaverton/>

### **6.02.215 Exhaust Brakes.**

No person shall use a compression braking system in conjunction with the operation of a motor vehicle, except to avoid imminent danger to person or property. Compression braking systems, commonly found on trucks and busses and referred to as "Jake" brakes, convert an internal combustion engine into an air compressor for the purpose of slowing or stopping a vehicle with the use of wheel brakes. [BC 6.02.215, added by Ordinance No. 3470, 10/7/85; amended by Ordinance No. 3538, 10/21/86]

## Oregon Speed Zoning Program & Discussion

Excerpts taken from <http://www.odot.state.or.us/traffic/speed.htm>

By law, the Oregon Department of Transportation is responsible for establishing speed zones on all highways in Oregon. The Traffic Management Section is responsible for the overall administration of the program. Region traffic engineering staff conduct engineering investigations to determine recommendations for safe speeds on local roads and streets. Cities and counties may appeal speed zoning recommendations to the Speed Zone Review Panel.

### Changing a Speed Zone

If a city or county thinks the speed for a particular street or highway should be changed it can make a request to ODOT for a review and investigation. Requests are submitted to the Traffic Management Section which initiates an investigation to determine if a speed zone should be changed. The Region traffic engineering staff conducts an investigation using procedures in accordance with nationally accepted traffic engineering standards. Factors taken into consideration are accident history, roadside culture, traffic volumes, and roadway alignment, width and surface.

A major factor in establishing speed zones is consideration of the 85th percentile speed. This is the speed at or below which 85 percent of the vehicles are traveling. This is used as an indication of the speed most drivers feel is reasonable and safe.

When the investigation is complete, a report with photographs detailing the existing conditions and proposed changes is prepared. The report is sent to the city or county for review. If the city or county agrees with the recommendation, the new speed zone is established.

If ODOT and the local road authority cannot reach agreement on the setting of a speed zone, the speed zone request is referred to the Speed Zone Review Panel. The panel is comprised of representatives of the Oregon Transportation Safety Committee, the Oregon State Police, the Association of Oregon Counties, the League of Oregon Cities, and the Department of Transportation. The panel hears ODOT's recommendations and testimony from the local road authority and makes the final decision.

Related email from Oregon Department of Transportation regarding speed control authority:

Hello Roger –

I've forwarded your email to someone who will send you the contact information for the state speed board. While the state approves all speed zones, the road authority actually performs the study and makes the recommendation on what speed to set. City of Portland is the road authority for SW Barnes. When setting a speed zone, ODOT does consider other variables in addition to the 85th percentile speed. Speed control is an important topic and there is information available; I think you may find this study informative :[Managing Speed: Review of Current Practice for Setting and Enforcing Speed Limits](http://gulliver.trb.org/publications/sr/sr254.pdf) by the TRB of the National Academy of Science at this link <http://gulliver.trb.org/publications/sr/sr254.pdf>.

Sincerely,

Chris Monsere  
*Highway Safety Engineer*  
Oregon Department of Transportation  
Traffic Management Section

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355 Capitol NE, Salem OR, 97301  
Voice - (503)-986-3580 Fax - (503)-986-4063  
[www.odot.state.or.us/traffic](http://www.odot.state.or.us/traffic)

-----Original Message-----

**From:** Roger M. Ellingson [mailto:rogere@rmegen.net]  
**Sent:** Sunday, August 24, 2003 8:23 PM  
**To:** ODOT Traffic Management  
**Subject:** Speed zones and noise and safety

Dear Speed Control Board,

I have lived in Washington County for 25 years along SW Barnes Road. I have endured an increasing build up of noise due to the heavy traffic on SW Barnes Road. When the state widened SW Barnes Road in 1983 for Washington County with federal money an EIS was performed that stated noise levels would not exceed 67dBA leq. I am now measuring typical noise levels of >71 and up 74dBA leq. Part of the reason for the increase in noise is the prevalence of illegal exhaust systems. But part of it is due to the speed of the vehicles. I have read that an increase of 10mph in vehicle speed can increase the noise level 10dB, which is effectively doubling the noise emissions. I am working on verifying that figure myself on Barnes Road.

I have noticed throughout Washington County and the metro area, there has been a huge increase in the posting of roads to 40mph. For example, coming west on Burnside out of Portland, the road is now posted 40mph. This has resulted in a 'race up the hill' condition that is absolutely ludicrous, inefficient, and unsafe, as well as encouraging erratic and noisy traffic on a very narrow winding road going over a mountain range inside an urban area. This also means cars blasting over Burnside to Barnes and onto the Barnes Road extension (which is also posted 40mph), do not slow down in the residential area I live in which is posted 35mph.

It appears to me the only criteria the state uses to post a road is the 85% rule. This rule does not take into account the impact of traffic noise and other related pollution when a speed limit is set. I also question whether just because 85% drive at a high rate of speed, it is safe to post the speed at the higher rate as they possibly really are out of control or beyond the design speed of the road. Or they make it really unsafe for others to pull out of residential driveways onto such busy roads. You guys also know just as well as I do that when you post it 40mph, 15% are going to drive at 50mph or even higher.

I would like to begin an investigation into the impacts of increasing speed posting on roads that extends beyond the simple 85% criteria. The attendant noise impacts for one thing, but safety for drivers and residents being another. It would help me to have a contact on the "state speed control board" so as to define what is reasonable to look into. Can you advise me as to who to contact to begin this work?

Thank you,  
Roger Ellingson  
8515 SW Barnes Road  
Portland, OR 97225  
503.297.5044

## References

[FHWA] Federal Highway Administration: <http://www.fhwa.dot.gov>

[NPC] Noise Pollution Clearing House: <http://www.nonoise.org>

Oregon State Speed Control Board: <http://www.odot.state.or.us/traffic/speed.htm>

<http://bksv.com> Noise and vibration equipment manufacturer. Products, application notes, references relating to measurement of environmental noise.

<http://www.nonoise.org/library/highway/policy.htm>

[FHWA1] "Highway Traffic Noise Analysis and Abatement Policy and Guidance":  
<http://www.fhwa.dot.gov/environment/polguid.pdf>

"Highway Traffic Noise": <http://www.fhwa.dot.gov/environment/htnoise.htm>

Oregon Department of Environmental Quality: <http://www.deq.state.or.us/>

Code of Federal Regulations: <http://www.access.gpo.gov/nara/cfr/cfr-table-search.html>

Oregon Revised Statutes(Chapter 467 Noise Control): <http://www.leg.state.or.us/ors>

Oregon Administrative Rules (Division 35 Noise Control Statutes): <http://arcweb.sos.state.or.us/banners/rules.htm>

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.Environmental Protection Agency, "Noise Emission Standards for Transportation Equipment", Title 40, Code of Federal Regulations, Chapter 1, Part 205, Subpart B - Medium and Heavy Trucks

Environmental Noise, Bruel & Kjaer excellent manual on sound & noise measurement.  
<http://www.bksv.com/pdf/Environmental%20Noise%20Booklet.pdf>

Sound Measurement Procedures Manual, NPCCS-1, DEQ, State of Oregon.

Index of online documents related to traffic noise:

<http://www.nonoise.org/resource/trans/highway/highway.htm>

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## **Additional Links**

Additional information on hearing conservation issues can be found at the following sites.

- [National Hearing Conservation Association](#)
- [Council for Accreditation in Occupational Hearing Conservation](#)
- [American Tinnitus Association](#)
- [National Council of Acoustical Consultants](#)
- [Institute of Noise Control Engineering of the USA](#)
- [The Acoustical Society of America](#)
- [Better Hearing Institute](#)
- [The League for the Hard of Hearing](#)
- [National Environmental Balancing Bureau](#)
- [Oregon Hearing Research Center](#)
- [Right to Quiet Society](#)
- [American Speech-Language-Hearing Association](#)
- [The EAR Foundation at Baptist Hospital](#)
- [Safe@Work](#)
- [Hearing Health Magazine](#)

## **Additional Resources**

[Noise Exposure Online Training Modules](#) self-paced, for employers and workers.

<http://www.lni.wa.gov/news/2003/pr030619a.asp>

[Noise Exposure Training Kit](#) for employers to use to train workers.

<http://www.lni.wa.gov/Safety/TrainTools/Trainer/Kits/HearingProtection/default.asp>

[Video tapes on hearing conservation](#) can be borrowed from the [L&I Safety & Health Video Library](#).

<http://www.lni.wa.gov/Safety/TrainTools/Videos/Library/catalog.asp>

<http://www.lni.wa.gov/Safety/KeepSafe/ReduceHazards/ErgoBank/default.asp>

OSHA hearing conservation technical and regulatory information can be found at their [Noise and Hearing Conservation](#) site.

<http://www.osha.gov>