

Comparing Sound Emissions of Snowmobiles to those of Road Vehicles

Greg Davis, Neil Marietta

ABSTRACT

The focus of this paper is to examine and compare sound emissions of production trail-riden snowmobiles to that of other everyday vehicles that travel by road such as passenger cars, motorcycles, and semi tractor/trailers. This paper will outline the standard test used by the Society of Automotive Engineers (SAE) that all production snowmobiles must pass before they can be sold to the public, and compare these numbers to actual test data of noise emissions produced by standard road vehicles.

INTRODUCTION

In order to actively control the level of sound emissions allowed by production snowmobiles, SAE has incorporated the J192 noise test. This test is currently the standard for all snowmobile manufactures and absolutely must be passed before a snowmobile can be produced and sold to the public. Many other organizations such as law enforcement agencies, national park services, and aftermarket part manufactures and testing agencies use this test or a close variation of it.

After the successful completion and compliance with the specifications laid out in SAE J192 a snowmobile is considered consumer and environmentally friendly. It is the single test that is the standard in use today to control and enforce the allowable emission of noise in current snowmobiles.

BACKGROUND

SAE J192 TESTING

The testing procedure used for the SAE J192 test is very clearly defined. The test is conducted by driving the snowmobile under wide-open (full) throttle through a 150-foot long test course with a microphone placed 50 feet to the side of the snowmobile. During the test a snowmobile is not allowed to exceed 78 decibels. This sound level limit takes into account all aspects of the snowmobile and all parts that create noise including the engine and its exhaust system, the track and suspension rotating, and the skis coming in contact with the running surface. For comparison purposes, a normal

conversation at a distance of three feet produces around 70 dB of sound.

In order to better understand how loud something is a basic understanding of the units of decibels must be obtained. In the simplest form, decibels are a non-linear unit, which means they do not increase on an equal scale. As a rule of thumb, for every 10 dB increase in sound, the human ear registers the new sound as twice as loud as the old one.

Table one is an example of some common things that produce sound. This information was taken from the International Snowmobile Manufacturers Association (ISMA) article titled "Snowmobile Facts: Noise." These values are simply for comparison purposes and to help better understand sounds that are encountered on a daily basis.

Table 1: Examples of Everyday Sound Levels

Sound Source	Sound Level dB(A)
75 piece orchestra	130
Car Horn, Snow blower	110
Blow dryer, Diesel Truck	100
Electric Shaver, Lawn Mower	85
Garbage Disposal, Vacuum	80
Alarm Clock, City Traffic	70
Dishwasher	60
Leaves Rustling, Refrigerator	40

As you can see we encounter a great deal of sound throughout an average day. From this information it is

visible that a sound level of 78 dB under full acceleration is not all that loud when compared to other common sound producers. Even when equipped with aftermarket exhaust, which is illegal in many states, sound levels did not exceed 84.5 decibels in a test conducted by an independent company, Off-road.com, made to exactly replicate SAE J192. While a lawn mower is running in the summer you hear more noise than when a snowmobile with twin aftermarket exhaust pipes manufactured by Starting Line Products (SLP) goes past your house at wide open throttle 50 feet away.

ON-ROAD VEHICLE TESTING

DESCRIPTION AND EQUIPMENT

In order to gain a better understanding of noise that is encountered from standard roadway traffic, sound level measurements were taken at multiple locations on a wide variety of vehicles and driving situations. In order to be able to make a direct comparison between the SAE J192 test, the same parameters were followed as closely as possible for this testing.

In order to accurately measure the sound level being emitted a Bruel & Kjaer Brand Precision Integrating Sound Level Meter, Type 2230 was used. The unit was calibrated on November 10, 2004 by North American Service and Calibration Center, 1-800-322-2040. Meter settings were as follows:

- Sound Value-Rms
- FSD-100
- Time Weighting-Fast
- Frequency Weighting-Fast
- Sound Incidence-Random

The meter was held 50 feet from the center line of the road and readings taken after vehicles had passed directly in front of the microphone. Two different test sites were used to acquire the best data and gain the best possible understanding of the sound levels present.

SITE 1

For the first test site the Chassell, MI, School Driveway was selected. This offered a relatively open area with little foliage and terrain changes to muffle sound. Vehicles could also be observed under multiple driving conditions because of a nearby curve and speed limit change. From this location many different types of vehicles were observed and their noise readings recorded, along with the driving situation; the speed of some was also obtained and recorded.

All data collected from this site can be seen in Table 2.

Table 2: Site 1 (Chassell School Driveway) Sound Level Recordings

Vehicle Description	Direction Traveling	Traveling Condition	Sound Level dB(A)
1997 Harley Davidson Wide Glide 1340cc with stock exhaust	Eastbound	Accelerating through a speed of 56 mph	101.9
Group of approximately 8 motorcycles of varying manufacturers	Westbound	Constant speed of 49 mph	90.6
Semi with new mufflers, no trailer	Westbound	Braking with exhaust(Jake) brake activated	90.7
Logging truck towing fully loaded trailer	Eastbound	Cruising at a constant speed of 45 mph	88.3
Double axle flatbed truck	Eastbound	Constant Speed	87.8
Semi with new mufflers, no trailer	Eastbound	Accelerating, speed: 45-50 mph	87.1
Semi with new mufflers, no trailer	Westbound	Coming to a stop with exhaust(Jake) brake activated, speed: 10 mph	83.4
Semi with new mufflers, no trailer	Eastbound	Accelerating from stop	81.8
4X4 pickup pulling boat trailer	Westbound	Constant Speed	81.2
Pickup with large aftermarket tires	Eastbound	Constant Speed	79.1
20 foot enclosed box truck	Eastbound	Constant Speed	79
Small pickup with trailer	Eastbound	Constant speed	77.2
Pickup truck	Eastbound	Constant Speed	76.2
Dual Axle Pickup	Eastbound	Constant Speed	75.6
Pickup truck	Westbound	Constant Speed	74.6
Late model Chrysler Sebring	Eastbound	Constant speed of 62 mph	72.2

SITE 2

For a second site somewhere with different sound characteristics was desired. An area near the Chassell/Portage township line on US HWY 41 was selected. This site provided thick forest near the road and allowed vehicles to be observed during an optimal cruise situation. With the thick forest along the road the sound waves would be better broken up and essentially dampened to provide the lowest readings possible.

At site 2 speeds were measured using a hand-held radar gun and were recorded in table 3 along with the sound level emission of the vehicles.

Note: all vehicles tested at this site were observed at a constant cruising speed applying very little throttle, completely opposite to that of the J192 test.

Table 3: Site 2 (Hwy 41 at Chassell/Portage Township Line) Sound Level Recordings

Vehicle Description	Speed	Sound Level dB(A)
Cadillac passenger car	56	70
Corvette	56	73
Chevrolet 4X4 pickup	56	76
Jeep	52	70.6
Semi with trailer	53	80.3
Semi with flatbed trailer	58	79
Pickup truck	59	80.7
Truck pulling camper	51	76
Off-Road Jeep	54	78

CONCLUSION

It is clearly seen that snowmobiles in fact do not make a great deal more noise than standard road vehicles. In many cases, snowmobiles are noticeably quieter. A snowmobile under full throttle emits the same sound level as truck pulling a camper or an off-road Jeep traveling at constant highway speeds applying very little throttle. So if you refer to a worst case scenario, a snowmobile leaving a stop sign and applying full throttle, the noise produced is still about the same as a very common vehicle simply cruising down the road.

Now, if we look at the worst case scenario in the opposite sense, a Harley Davidson motorcycle accelerating and applying nearly full throttle produces nearly 6 times the noise to your ear that a snowmobile driving the same way produces. In a more common example, a logging truck pulling a loaded trailer down the

highway traveling at 45 mph will produce twice the noise of a snowmobile applying full throttle.

It has been demonstrated here that the common snowmobile is simply not allowed under law to produce the sound levels, under any type of driving condition, that common road vehicles produce everyday. It is illegal for a snowmobile being driven under full throttle to be as loud as a semi tractor/trailer cruising down the highway each and everyday.

REFERENCES

1. International Snowmobiling Manufacturer's Association, "Snowmobiling Facts: Sound"; http://www.snowmobile.org/facts_sound.asp
2. Snowmobile Online, "What is Noise? Is Snowmobiling being Silenced?"; <http://www.off-road.com/snowmobile/info/sound/whatisnoise.htm>
3. Construction Work Center, "Perception of Changes in Sound;"; http://www.constructionwork.com/resources_details_1283perception_of_changes_in_sound.html

AUTHORS

Greg Davis is a senior Mechanical Engineering Student at Michigan Technological University. He was the team leader of the MTU SAE Clean Snowmobile Challenge Team in 2004/2005, an active member of the Snowmobile Club of MTU, and an avid snowmobile rider.

Neil Marietta is the owner and operator of Bunker Hill Recreation located in Dollar Bay, MI.